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CONTENTS.

ORIGINAL CONTRIBUTIONS.

PAGE
Note Explanatory on the Copyright of Railway Plans. By John Herapath, Esq....... 6
Answer to the Strictures on Mr. Herapath's Article on the Greenwich Railway. By Anti-H. ib.
Description of an Expeditious Razor-Sharpener. By D. Pring, Esq., M.D. 8
Ephemeris of Halley's Comet. By J. W. Woollgar, Esq......................... 9
On Training the Vine. By Mr. J. Hayward .... ib.
Electrical Theory of the Universe. By Mr. T. S. Mackintosh...................... 11
——————. Art. I................. 227
——————. Art. II............... 292
——————. Art. III............... 419
On an Alleged Infringement of Mr. Hicks's Patent Gas-cooking Apparatus. By Mr. J. T. Beale, Engineer.. 13
Remarks on Mr. Herapath's Principles of Railway Locomotion. By Iver Maciver..15, 43, 123, 195, 219, 250, 275, 323, 394, 433, 500
Description of Pendulum Lights for Ships' Guns. By Lieut. Wall, R.N.............. 18
On the *English* of the Patent Law Amendment Act 19
On Railways. By John Herapath, Esq. The Greenwich Railway.................. 20
——————. Eastern Counties Railway 51
On Fire-proof Buildings. By Mr. Christopher Davy, Architect.................. 22, 74
On the Improved Metropolitan Street-Paving. By C. B. 23
Description of a Two-Way Steam-Cock, which answers all the Purposes of the common Four-Way Cock. By Mr. W. Buckland................................ 24
On Water as a Prime Mover. By Mr. W. Baddeley.............................. 25
Autobiographical Passages in the Life of Mr. Nash. By W. A. R. 26
Illustrations of the Phenomena of Halley's Comet. By J. W. Woollgar, Esq. 29
Description of a simple Mariner's Log. By Mr. G. S. Holland..................... 30
On the Working and Authorship of the Letters Patent Amendment Act 31
Description of, and Reports of Performances of, Hunter's Stone-Planing Machine 34
Description of Dr. Williams's Self-inflating Life-Buoy............................ 40
Description of Sowerby's Patent Improvements for Securing Ships' Windlasses. By the Patentee 41
Notes of a Traveller, on American Steam Navigation...................... 44, 76, 115
On the Working of the Patent Law Amendment Act 47
Mechanical Analysis of the Buckingham Ploughing Match. By Mr. William Andrews, Land-Surveyor 54
Observations on the Practicability of Guiding and Directing Air-Balloons, or Aerial Ships. By Mr. T. S. Mackintosh 55
Opinions of Sir Frederick Pollock and John Steer, Esq., on the Letters Patent Law Amendment Act.. 61
On Mr. Rosser's Misrepresentations with respect to the Working of the Patent Law Amendment Act.. 63
Corrections of some Errors in Dr. Lardner's Evidence before the House of Lords on the Great Western Railway Bill. By Dr. Lardner 67
Reply to Iver M'Iver's Strictures on Mr. Herapath's Railway Theorems. By Anti-Carper ib.
Memoir on the Thames Tunnel. By ‡. 68
Description of a Method of Freeing a Vessel from Water by her Heeling. By ⊕. 72
Description of a Water Gas-valve. By Mr. Peter Horsman, Secretary, Shrewsbury Mechanics' Institution 73
On the Improved Metropolitan Street-paving. By. Q. 74
Claim of the Invention of the Improved Paving. By Mr. John Watson, Superintendent of Ramsgate Harbour Works.. ib.
Reply to Mr. Beale on the alleged Infringement of Hicks's Patent for Gas-cooking. By Mr. T. G. Barlow 80
On the Ship-sinking System; with copy of Correspondence between the Secretary of Lloyd's and Captain Ballingall. By Captain James Ballingall.................. 83
Notice of Mr. R. N. Fox's Chart of the Inclination of the Dipping Needle 86
Description of Young's increased purchase for Ships' Windlasses. By Mr. T. Sowerby 92
On Railway Platforms, and Description of a New Slate Platform. By Joseph Jopling, Esq., Architect.. 98
On the probable Connexion between Electricity and Vegetation. By Mr. T. Pine 99
On Rotary Steam-engines, and Avery's in particular............................ 104
On the Ship-sinking System. By Captain James Ballingall...................... 105
Description of an Effectual Cure for Smoky Chimney. By Mr. L. Mundy 121

PAGE
Reply to Mr. Barlow on Hicks's Gas-cooking Apparatus. By Mr. J. T. Beale 122
Further Observations on Slate Railway Platforms. By Joseph Jopling, Esq. 124
Some Suggestions on Preventing Poisoning by Arsenic. By J. K—n. 125
Description of Steel's Self-feeding and Smoke-consuming Furnace.................... 130
Observations on the Memoir on the Thames Tunnel. By Mr. Thomas Deakin 131
Strictures on Mr. Herapath's Account of the Greenwich Railway. By H. 133
On Mr. Herapath's and Iver M'Iver's Railway Theorems. By S. Y. 134
On the Grand Trunk Railway System. By Mr. Thomas Gray........................ ib.
On the Cultivation of the Vine in England. By Mr. Henry Watson 135
Description of the Nottingham Hydraulic Gas-vale. By A. Y. 137
On the London and Portsmouth Railway. By Viator 159
Description of Hynes's Patent Carriage-wheels, Axles, and Boxes 161
Memoir on the Kirkby Slate. By Joseph Jopling, Esq. 164
On Slate Railway-platforms. By Colonel Francis Maceroni 166
Further Strictures on Mr. Herapath's Account of the Greenwich and Brighton Railways, in Answer to Anti-H. By H.. ib.
Description of a Design for a Foot-passenger Bridge and River-arcade between Hungerford and Lambeth. By Mr William Ranwell...... 193
On Iver M'Iver's Correction of Mr. Herapath's Railway Theorem. By Anti-Carper .. 194
Receipt for Making Indian Ink. By Henricus.................................... 197
Hints on an Improved Construction for Chimneys. By Mr. G. L. Smart 199
On the Practicability of Aerial Navigation by Birds. By ⊕. 200
Remarks on the Construction of Bog-roads. By Mr. Frederick Lush 204
On the Superiority of English over Foreign Workmen. By Mr. T. S. Mackintosh.... 205
Vindication of Mr. Herapath's Account of the Greenwich Railway. By Philo-Anti-H.. 206
Mention of an Invention for Embossing on Wood. By P. B. T...................... ib.
Remarks on Mr. Cooper's Great Achromatic Telescope 210
Claim to the Invention of the Self-feeding and Smoke-consuming Furnaces. By Mr. J. Dickson, Engineer 215
On the Application of Archimedes' Screw for Freeing Leaky Vessels from Water. By J. E. ib.
On Mr. Herapath's Locomotive Theorems. By S. Y............................ 220
On the Navigation of the Tyne. By Keenams.......................... .... ib.
Hints on Slate Railway-platforms—Coal-tar a Preservative of Stone—Organic Action. By Colonel Francis Maceroni.. 220
On the Originality of the Design of the Greenwich Railway. By P. S. H............ 221
Description of Merryweather's Improved Fire-engine. By Mr. W. Baddeley 226
Description of Parkin's Patent Railway 234
On Mr. Herapath's Railway Papers. By Miso-Philo-Anti-H.......................... 236
Description and Remarks upon Mr. Galloway's Patent Paddle-wheel 241
Suggestion for the Relief of the Whale-Ships beset in the Ice. By Mr. W. Vere...... 251
On the Use of Zinc Gutters as a Preventative against Fire. By Mr. W. Baddeley .... ib.
Reply to Capt. Ballingall on the Ship-sinking System. By an Old Correspondent 252
Suggestions on the Navigation of the Atlantic by Steam. By Capt. E. Talebois 258
Remarks on several Plans for Freeing Leaky Ships from Water. By ⊕.............. 260
On the Use of Bricks for Paving. By Mr. F. Lush 261
On the State of the Arts of Design in England; with a Postscript on Taxidermy and Travertino. By Colonel Maceroni 262
Remarks on Mr. Galloway's Patent Paddle-wheel. By Scrutator Mechanicus 271
Note on the Discussion on Railway Theorems. By S. Y............................ ib.
Description of Hutchison's Patent Portable Lever................................ 274
On Improvements in Street-paving. By T. C.................................... ib.
On the State of the Arts of Design in England, and Engraving in Metallic Relief. By R. R. 277
Reply to the Editor's Remarks on Mr. Galloway's Conduct in relation to his New Paddle-wheel. By Mr. Thomas Gill, Engineer 278
Further Remarks by the Editor on Mr. Galloway and his Paddle-wheel .... ib.
Notice of the First Disclaimer under the late Patent Law Amendment Act 280
Some Suggestions respecting a New Principle in the Construction of Railways for Locomotive Engines. By Mr. John Bravender, Author of the "Great Western Railway compared with others," "The Railway Table," &c......................... 280
Notice of a New Motive-power, called the Eudio-engine. By Mr. Augustus Brackenbury 282
Description of Palmer's Patent Excavating and Self-loading Cart.................... 290
Suggestion of Whalebone Steel Pen-holders. By Jonathan 292
On Galloway's Patent Paddle. By Mr. R. Williams 295

PAGE
Description of a New Mode of Ventilating Railway Tunnels. By Mr. G. L. Smart .. 296
Comparison of Mr. Herapath's and Iver M'Iver's Railway Theorems. By a Looker-on 297
Hints on Hardening and Protecting Stone, Wood, Metal, &c., and on the Preservation of Panoramas. By Colonel Maceroni ... 309
Remarks on Hydraulic Gas-valves. By Clovis ... 311
Materials for a New Epistle to the Phillipians, being Strictures on Sir Richard Phillip's Theory of the Universe. By Mr. J. Utting, C. E. ... 312
On Mr. Herapath and his Railway Theorems. By Mr. F. M. Meredith ... 319
Description of Hutchison's Double-lifting Gasometer. By Clovis ... 322
Abstracts of, and Remarks on, Specifications of New Patents:—John Losh, for Improvements in Calico-printing—Joseph Nye, for Injecting Apparatus—Richard Phillips, for Manufacturing Sulphate of Soda—James Leman, for Soap—James Mitchell, for Improvements in Smelting—William Crofts, for Bobbin-net Lace Machinery—the "Monster Specification" ... 346
On the Principles of Railway Transit. By Mentor ... 349
On Mr. Mackintosh's Electrical Theory of the Universe. By G. W. L. ... 350
Report on London Fires in 1835. By Mr. W. Baddeley ... 354
Further Remarks on the "Monster Specification" of Mr. William Crofts's Patent for Bobbin-net Lace Machinery ... 377
Claim of the Invention of the Double-lifting Gasometer. By Mr. William Tait ... 380
Proposal for a Trial of the respective Merits of Symington's and Galloway's Paddle-wheels. By Mr. W. Symington ... ib.
On the Herapathian Controversy. By Mr. William Cooper ... 381
On Iver M'Iver's Table of Velocities. By S. Y. ... 382
Description of Patent Condensing Steam Fire-engine, and Railway Condensing Locomotive. By Mr. S. W. Nickoll ... 386
Note on Mr. Perkins's Steam-boiler ... 387
Description of a Safety Method of Lighting Coal Mines. By Mr. David Booth ... 392
On the Prevention of Accidents in Mines. By Mr. Augustus Brackenbury ... 393
Theory of Nutation. By J. K. ... 395
On the Failure of the London Mechanics' Institution to accomplish its Original Design. By A Seceded Member ... 397
Description of Martin's Safety-lamp. By Pollsa ... 402
On Electro-Vegetation. By Mr. T. Pine ... ib.
Description of a New Hydraulic Gas-valve. By Mr. J. Thomas ... 408
Description of an Atmospheric-engine, and Self-registering Barometer. By W. M. G. 409
Proposal of a Continuous Stone Railroad. By a Promoter of Railways ... 411
Answer to Mr. W. Tait's Claim of the Invention of Double-lifting Gasometers. By Clovis 413
Notice of Scrivener's Wrought-iron Railway-chairs. By a Subscriber ... 415
On the Working of the Patent Law Amendment Act. By a Correspondent ... ib.
Description of Hutchison's Patent Aerometer. By C ... 418
On the British Museum. By the Friend of the Industrial Classes ... 430
On English and American Steamers, and Avery's Rotary-engine. By E ... 432
Historical Retrospect of the Caoutchouc Manufacture ... 434
Reply to Clovis on the Invention of the Double-acting Gasometer. By Mr. W. Tait ... 442
On Mr. Hansom's New Safety-cab ... 444
Description of Rapson's Steering-apparatus ... 450
On Railway Gradients. By C. E. ... 453
Suggestion of an Improvement in Paddle-wheel Boards. By X. Y. Z. ... 453
Rejoinder to Mr. Tait on the Invention of the Double-lifting Gasometer. By Clovis ... 455
Description of a Method of Employing the Escape-steam of a Steam-engine for Distilling and other purposes, invented by Capt. Davis Embree ... 456
Remarks on the Hot-water Heating System. By E. J ... 458
Note on Perkins's Circulating Steam-boiler. By Jacob Perkins, Esq. ... 459
Remarks on the Patent Caoutchouc Case, and Report of the Proceedings, 460, 469, 489, 508, 529
Description of Dr. Ure's Patent Corrugated Sugar-Pan or Teache ... 466
On Henshall's Calculating-rule. By J. W. Woollgar, Esq ... 468
Memoir on Shalders' Patent Fountain-pump. By Mr. Shalders and Son ... 482
On Edmonds's Life Annuity Scales. By J. W. Woollgar, Esq ... 487
Notice of Sheridan's Patent for Making Soap from Flint ... ib.
Report of the Proceedings before the Privy Council on Wells's Patent for a Sea-water Purifying Apparatus ... 488
Surrejoinder to Clovis on the Invention of the Double-lifting Gasometer. By Mr. W. *Tait* ... 49

PAGE
On the Adaptation of Sheer Masts to vessels, and particularly First-rate Ships. By ⊕. 498
Explanatory Note on Evidence on Safety-lamps. By Mr. J. Murray.................. 500
Epitome of the Problems of Dr. Roget's Sliding-rule of Involution. By J. W. Woollgar, Esq. 501
On the Long-work System of Mining. By "The Black Diamond" 504
On the Same. By Mr. Thomas Deakin.. ib.
Note on the two preceding Articles. By the Editor................................ 505
On Provincial Museums and District Institutions, and the British Museum. By S. S. 507
A Postscript to the Epistle to the Phillipians. By Mr. John Utting, C. E. 514
On the Resources of India 519
On the Evil Effects of the System of Marine Insurance at Lloyd's. By L. 523
Description of a Way to obtain an Electrical Shock from a Sheet of Paper. By Mr. G. Dakin 525
On District Museums and the British Museum. By P. P. C. R. .... ib.
Golden Railway Rules (with Editorial Notes). By Mr. Thomas Gray, C. E. 527
Description of an Improved Throstle-frame Spindle. By Mr. James Whitelaw, C. E. 536
On Electro-vegetation. By Mr. T. Pine 537
Description of an Improved Method of Taking Levels. By Mr. James Utting, C.E... 541
On Tuning Instruments with Fixed Tones. By Corio................................ ib.
On the Superiority of Machine-made Bricks. By J. J. C............................ 542

REVIEWS AND CRITICAL NOTICES.

PAGE
A few Cursory Remarks on Railways. By Thomas Hammond 52
Dublin Penny Magazine 210
Athenæum .... ib.
The Almanacs for 1836.............. ...237, 253
A Million of Facts. By Sir Richard Phillips.. 312
Second Report on Railways. By Professor Barlow 366
Character of Lord Bacon, his Life, and Works. By Thomas Martin, Esq. 371
Magazine of Popular Science 387
PAGE
Gas-lighting Projects. By Mr. W. Matthews 445
Gun Manufacture of Birmingham (Supplement to Penny Magazine) 464
A Practical Treatise on the Slide Rule. By Mr. J. Henshall.......................... 468
Life Tables. By Mr. T. R. Edmonds, B.A. .. 487
Letter to Benjamin Hawes, Esq., on the British Museum. By Mr. Edward Edwards....508, 527
Botany of the Himalayan Mountains. By J. F. Royle, Esq. 519

EXTRACTS.

PAGE
Description of Bergin's Patent Railway Buffing-apparatus 2
Autobiographical Passages in the Life of Mr. Nash 26
Remarks on the Construction of Bog-roads. By W. Bald, Esq., C. E. 30
Ephemeris of Halley's Comet................ 42
Perilous American Balloon Ascent .... ib.
Description of Avery's Rotary-engine 50
Description of Condert's Diving-apparatus.... 66
Report of the Royal Cornwall Polytechnic Society 84
Method of Preserving Marble by Waxing.... 94
Extracts from the Evidence given before the House of Commons' Committee, on Arts and Manufactures............105, 126, 138, 168, 201
Description of Jones's Magic Lantern 113
Description of Barnes's Standing-press 1
Premiums offered by the Royal Cornwall Polytechnic Society, for 1836 196
Report of Trials of Austen's Steam-engine .. 197
Observations on the Trial of Austen's Steam-engine 207
Description of Mr. Cooper's Great Achromatic Telescope 210
On the Application of the Hot-blast in the Manufacture of Cast-iron. By Thomas Clark, M.D., Professor of Chemistry in Marischall College, Aberdeen 211
Alloys, Solders, and Amalgams, used in the Arts 216
Report of the Select Committee of the House of Commons, on Accidents in Mines...... 245
PAGE
Extracts from the Evidence given before the Committee on Accidents in Mines, 264, 283, 298, 314, 327, 505
Description of an Iron-trussed Roof constructed over the Boring-room of the Cossipore Gun-foundry. By Major Hutchinson 306
On the Causes of Steam-boiler Explosions.... 308
Description of a Mode of Freeing Steam-boilers from Limestone Deposits 309
Experiments on the Influence of Colour, and of Rough and Smooth Surfaces, on the Radiadiation of Heat made by Professor Bache.. 325
Mr Gibbs's Remarks on Railway Tunnels.... 382
Experiments to Ascertain the Existence of Lead in the Atmosphere of a White-lead Foundry. By Mr. Arthur Dunn.................... ... 383
Description of an Easy Method of Filling long Syphon-tubes. By William Foster, Esq. .. 384
Memoir on Mr. Perkins's Circulating Steam-boiler 387
Description of Mr. Goldsworthy Gurney's Safety-method of Lighting Mines 405
Description of an Improved Method of Blasting Rocks........... 415
Account of the Annual Meteoric Showers in America 454
The only Safe Position for Iron Safes 457
Description of Hosking's Portable Punching-press 514
On the Manufacture and Use of Soluble Glass 515
On the Resources of India, and the Cultivation of East India Tobacco 519

NEW PATENTS.

English 96, 191, 255, 351, 447, 543
Scotch 192, 272, 352, 447, 544
American 88, 222, 323

NOTES AND NOTICES.

PAGE
Bamboo Canes 16
New Comet ib.
Drowning a Fish ib.
Taste in Humble Life 32
Antiquity of Lead Mines ib.
Calculating Machines 48
Wooden Pavements ib.
Brussels Railway ib.
Windmill Ship ib.
The Greenwich Railway ib.
The Needle in Iron Boats ib.
New Street 64
Importance of Pure Air ib.
System of the Universe ib.
Steam Navigation between England and America 95
Telegraph between London and Paris ib.
Navigation of the Danube ib.
Traces of Ancient Civilisation among the South Sea Islands ib.
French Carts ib.
Improvidence of the Poor ib.
The Institute of British Architects 96
The Railroad System ib.
Portland Breakwater 112
To Purify Foul Casks ib.
Manufacture of Salt ib.
The Macropona ib.
Flax Spinning ib.
A New Paper-hanging 128
The New Paving ib.
Height of Waves 160
Bath and Weymouth Railway ib.
Dublin and Kingstown Railway ib.
Fribourg Suspension Bridge ib.
Steam-engine Work ib.
Bell-rock Lighthouse 208
Honourable Tribute from Workmen to their Employer ib.
Steam Plough 224
Barlow's New Safety Boiler ib.
Railway Phenomenon ib.
Sugar from Indian Corn ib.
An Air Violin ib.
Extension of the Term of a Patent under the Late Patent Law Amendment Act 239
Another Proof of the *Inferiority* of English Artisans ib.
A Hand Water-engine 240
PAGE
Irish and Virginian Tobacco 240
Fossil Tree ib.
The Moon Inhabited ib.
Centrifugal Force ib.
New Hydrostatic Engine ib.
Railway Table Cloth 255
New India-rubber Fabric ib.
French Patents ib.
Opening of the First German Railway ib.
Mechanical Origin of the Foley Family 288
Test of Gas ib.
Institute of British Architects ib.
Improvement in Mails ib.
New Railway System 304
The Great Consols ib.
The Comet 320
Chimney Cowl ib.
The Cossipore Foundry Roof 351
The Hereford Bone-crushing Machine ib.
Architectural Prize 384
Liverpool and Manchester Railway 400
New Thermometrical Scale ib.
Extraordinary Effects of Concussion ib.
Electrical Theory of the Universe 416
London Fire-engine Establishment ib.
Extensibility of Gold, Silver, and Platina ib.
A 200-Scavenger Power ib.
Mechanical Kneading-trough ib.
Railway Tunnels ib.
Foreign Railways 447
Sawing Extraordinary ib.
A Wheelbarrow with its own Railway ib.
Railway Transit ib.
The Gun Manufacture of Birmingham 464
Mr. Hall's Steam-engine Improvements ib.
Fall of a Windmill ib.
Metallic Lighthouses 480
Preservation of Animal Matter 496
Adhesion on Railways ib.
Cast and Wrought-iron Wheels ib.
New Application of Caoutchouc ib.
French Academy Prize ib.
New Railway Locomotive 512
Sugar from Beet-root ib.
Longitude at Sea ib.
Naval Gas-lighting ib.
Improved Music-stand ib.
&c. &c.

NEW PATENTS.

BRITISH:

[*₊* E. and S., Patents for England and Scotland; S., Scotland; the others for England.]

PAGE
J. Spiller, steam-boiler, (E. and S.) 96, 192
W. S. Henson, bobbin-net lace machinery ib.
E. Hoare, dyeing ib.
J. Bullough, hand and power-looms, (E. & S.) 96, 352
C. P. Devaux, smelting iron, (E. and S.) 96, 192
A. Howard, hand and power-looms 96
T. Jevons, horse-shoe-making machine, (E. and S.) 96, 352
R. Jupe, flower, &c., stands, (E. and S.) 96, 192
J. W. Fraser, submarine apparatus 96
J. Bird, printers' ink ib.
S. Draper, weaving ib.
D. Mushet, manufacturing bar iron ib.
S. Colt, fire-arms ib.
R. Barber, cotton-reels ib.
S. Slocum, pin-making machinery, (E. & S.) 96, 192
J. Deer, clarifying liquids 96
W. Patterson, tanning, (E. and S.) 96, 192
G. Baxter, printing engravings in colours 96
J. Walton, dressing cloth ib.
J. Baring, wool, &c., combing ib.
J. Bickby, machinery for pointing wire for needles, (E. and S.) 191, 192, 544
J. Springall and R. Ransome, ploughs 191
W. Keene, seed-sowing-machine ib.
J. Chanter and J. Gray, smoke-consuming furnace *ib.*
PAGE
W. Crofts, bobbin-net lace machinery 191
J. Whitehead, scouring and cleansing 192
Earl of Dundonald, locomotive machinery ib.
H. Adcock, improvements at docks, &c. ib.
W. Symington, propelling vessels, (E. & S.) 192, 352
J. Wilde and J. Whitworth, knitting 192
T. Gregg, embossing & printing, (E. & S.) 192, 352
J. Ericson, apparatus for ascertaining depths of sea 192
J. W. Fraser, diving-apparatus ib.
N. Troughton, finishing ornamental walls ib.
J. Cropper and T. B. Milnes, bobbin-net lace machinery ib.
J. J. C. Sheridan, fermentation ib.
W. Wilkinson, propelling vessels, (S.) ib.
W. Lucy, steam-engines, (S.) ib.
H. F. Bacon, gas-valve, (S.) ib.
T. F. Bergin suspending railway carriages, (S.) ib.
W. Longfield, lock, (S.) ib.
E. Galloway, paddle-wheels, (S.) ib.
G. E. Donisthorpe and H. Rawson, wool combing, (S.) ib.
R. Whiteside, steam-carriages, (S.) ib.
C. P. Chapman, calico-printing, &c. 255
J. Hellewell, waterproof fabric ib.
H. Jefferies, buttons ib.
T. R. Sewell, bobbin-net lace machinery ib.

PAGE
J. Cropper and T. Brown, ditto.............. 255
W. W. Potts, earthenware printing, (E. and S.) 255, 544
B. Woodcroft, calico printing................ 255
T. Parkin, railway sleepers.................. ib.
A. Gordon and J. Deville, lighting .... ib.
R. Witty, building .... ib.
J. Radley, steam-gauge .... ib.
M. Berry, power-looms, (E. and S.) 255, 544
N. Partridge, anti-attrition................. 255
R. W. Sievier, waterproof fabric............. 256
N. Partridge, mixing paints.................. ib.
J. S. Dawes, manufacturing iron .... ib.
J. Horsfall and J. Kenyon, carding machinery ib.
J. Bertie, bobbin-net lace .... ib.
J. Houldsworth, drawing and slubbing-frames, (E. and S.) 256, 272
L. Simpson, colours for printing cotton, (E. and S.) 256, 447
F. Hempel, oxydizing animal substances 256
D. Dewhurst and T. J. and J. Hope, spinning ib.
W. Carpmael, steam-engines................. ib.
R. Griffiths, screw-making, (E. and S.) ..256, 544
W. Coles, locomotive-carriages 256
J. Osbaldeston, metal heald.................. ib.
O. Topham, getting up lace .... ib.
J. Warrick, lock .... ib.
H. Booth, attaching railway carriages .... ib.
P. Erard, harps .... ib.
J. Baillie and J. Patterson, propelling vessels, (E. and S.) 256, 544
J. Howell, musical instrument 256
N. Troughton, copper-smelting................ ib.
J. T. Betts, brandy .... ib.
J. Heathcoat, weaving........................ ib.
J. Reynolds, railways, (S.) 272
S. Faulkner, carding-machinery, (S.) .... ib.
M. Berry, gas-meters, (S.) .... ib.
J. Fussel, pumps 351
J. Skinner, cutting veneers, (E. and S.) 351, 352
J. Hyde, carding-machinery 351
P. Erard, piano-fortes....................... ib.
J. Blyth, retarding carriages................ ib.
T. L. Wright, cleansing feathers .... ib.
J. Champion, cotton-spinning................. ib.
J. Ramsbottom, ditto......................... ib.
W. Harter, silk-winding, &c., (E. and S.) 351, 352
F. Brewin, tanning, (E. and S.)..........352, 544
J. T. Slade, machine for raising earth 352
J. W. Higham, razor, &c., sharpener......... ib.
J. B. Smith, machinery for tentering cloth .. ib.
M. Poole, Jacquard-looms, (E. and S.)....352, 447
C. Brandt, evaporating, &c., fluids 352
F. Moll, preserving vegetable substances (E. and S.)..........................352, 447
C. Harsleben, propelling vessels and carriages 352
R. Bowie, distillation .... ib.
J. Ferrabee and R. Olyburn, power-looms.... ib.
W. Burch, silk, &c., printing .... ib.
J. Jeffreys, curing disorders in the lungs, (E. and S.) 352, 447
H. Booth, railway carriages 352
H. Peckworth, propelling vessels .... ib.
J. J. C. Sheridan, soap, (S.) .... ib.
E. Galloway, steam-engines, (S.)............. ib.
J. Malam, gas-meters, (S.) .... ib.
J. Whitworth, spinning, (S.) .... ib.
PAGE
A. Smith, ships' rigging, (S.)................ 352
J. Day, carriage-wheel, (S.) .... ib.
J. C. Douglas, vinegar making, (S.) .... ib.
J. G. Bodmer, roving machinery, (S.)......... ib.
J. Hewitt, substitute for soap, (S.) .... ib.
J. Brown, paper-making, (S.)................. ib.
J. Kean, throstle-flyer, (S.)................. ib.
E. Ashworth and J. Greenough, machinery for preparing, &c., cotton, &c. (E. and S.) 447, 448
J. F. Kingston, rotary-engine................ 447
W. Bulnois, carriage springs................. ib.
S. Reed, hooks and bows for raising weights.. 448
J. Baring, wool-combing machinery .... ib.
F. E. Harvey and J. Brown, making metallic tubes, &c .... ib.
H. Adcock, loading and unloading vessels.... ib.
A. Massie, R. Morton, W. and E. Ranwell, paddle-wheels .... ib.
F. H. Maberly, sweeping-streets .... ib.
S. Fenton, locks............................. ib.
J. H. Kyan, preserving vegetable substances ib.
A. Smith, improvements in power-engines .... ib.
C. Schafhautl, steam-generator, (E. & S.) 448, 544
J. P. Westhead, cutting caoutchouc, &c. ... 448
M. H. Simpson, heckling, &c., machinery.... ib.
J. Lidel, piano-fortes........................ ib.
W. Bucknall, propelling vessels .... ib.
F. Chaplin, tanning .... ib.
H. M. Robinson, lamps........................ ib.
J. Barsham, manufacture of oxalic acid, (E. and S.) 448, 544
F. Pyre, ships' hearths 448
C. G. Gilroy, weaving, (E. and S.) 448, 544
W. G. and R. Scarth, blue dye 543
J. Barron and E. Thomas, bedsteads .... ib.
R. W. Sievier, dissolving caoutchouc .... ib.
J. Martin, ditto .... ib.
W. Bates, finishing hosiery, &c. .... ib.
C. Schafhautl, rotary motion, (E. and S.) 543, 544
A. T. Merry, white metal..................... 543
J. Morison, Jacquard-looms, (E. and S.)....543, 544
T. J. Hartley, preparing caoutchouc 543
J. Godwin, piano-fortes...................... ib.
B. Simmons, retorts, &c...................... ib.
G. H. Palmer, purifying gas .... ib.
C. Guynemer, piano-fortes.................... ib.
G. Lawrence, bottle-stoppers, &c. .... ib.
J. Diggle, steam-engines..................... ib.
C. Watt, purifying oils...................... ib.
J. Masters, essence of anchovies............. ib.
J. Chalklen and T. Bonham, vice .... ib.
E. Jelowicki, steam-engines .... ib.
T. Alcock, bobbin-net lace machinery .... ib.
A. W. Webster, hearing instrument........... 544
L. E. Seignette, preserving animal and vegetable substances .... ib.
W. Hancock, propelling vessels .... ib.
R. B. Bate, hydrometers and saccharometers.. ib.
F. G. Spilsbury, stamping up metals .... ib.
W. Maugham, chloride of lime................ ib.
W. Hale, propelling vessels.................. ib.
W. W. Richards, fire-arms.................... ib.
J. Cox, soap .... ib.
Sir J. S. Lillie, propelling carriages and vessels ib.
J. L. Hood, manufacturing straps .... ib.
W. Blurton, milking cows .... ib.
W. Wilson, wire-chain making, (S.) .... ib.

AMERICAN.

PAGE
J. Eames, theodolite 88
J. H. Taylor and A. J. Cowley, shelling corn 89
J. Ames, paper-making .... ib.
L. Garfield, waterproof roofs................ ib.
B. Johnson, plough 90
T. Daplyn, percussion-lock 90
J. Morris, meat-cutting machine .... ib.
J. Ross, thrashing-machine .... ib.
J. Ross, machine for cleaning seeds.......... 91
N. Robinson, plough .... ib.
J. Harley, casting chilled rollers, &c. 222
J. Rathbone, cook stove .... ib.
J. Donn, fishing-boat .... ib.
PAGE
J. Andrews, tailors' shears 223
J. Stone, water-closet .... ib.
C. Fowler and E. Hanks, catching fish........ ib.
A. Field, use of the saw .... ib.
W. Hess, plough .... ib.
E. Chassaing, tobacco 224
J. Fox, regulating water in boilers 323
H. Bachmann, tread-pump...................... ib.
J. C. Smith, new material for stuffing beds.... 324
W. Scarborough, generating steam .... ib.
J. Belote, tanning .... ib.
M. W. Baldwin, locomotives, wheels, and boilers 325

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BERGIN'S PATENT RAILWAY BUFFING-APPARATUS.

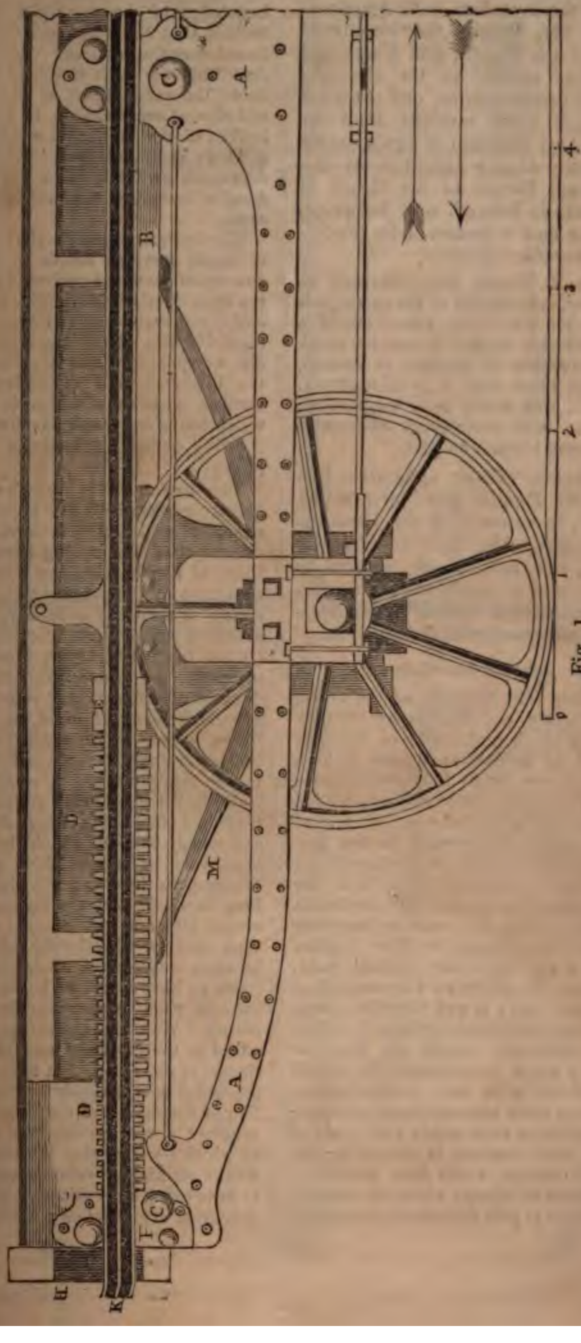


Fig. 1.

BERGIN'S PATENT RAILWAY BUFFING-APPARATUS.

We have more than once had occasion to mention the ingenious buffing-apparatus which Mr. Bergin, the intelligent Secretary of the Dublin and Kingstown Railway, has applied to the carriages under his superintendence, and the good effects which have resulted from its adoption. Our attention is again drawn to the merits of the invention by the Third Annual Report of the Board of Public Works in Ireland, now before us, in which we find it spoken of in the following favourable terms:—

"Thomas F. Bergin, Esq., Secretary to the Company, has applied to the carriages a spring-bar (for which he has obtained a patent), admirably adapted to ease the shock of sudden stopping or putting in motion, while, at the same time, it is more strong, more simple, and much more economical, and attended with other great advantages over the system hitherto adopted."

A description of the apparatus, furnished by Mr. Bergin, and illustrated by engravings, is annexed to the Commissioners' Report. We shall now transfer the former, with but little abridgment, to our pages; and so much, also, of the latter as is necessary to a clear understanding of the construction of the apparatus.

Mr. Bergin's Description.

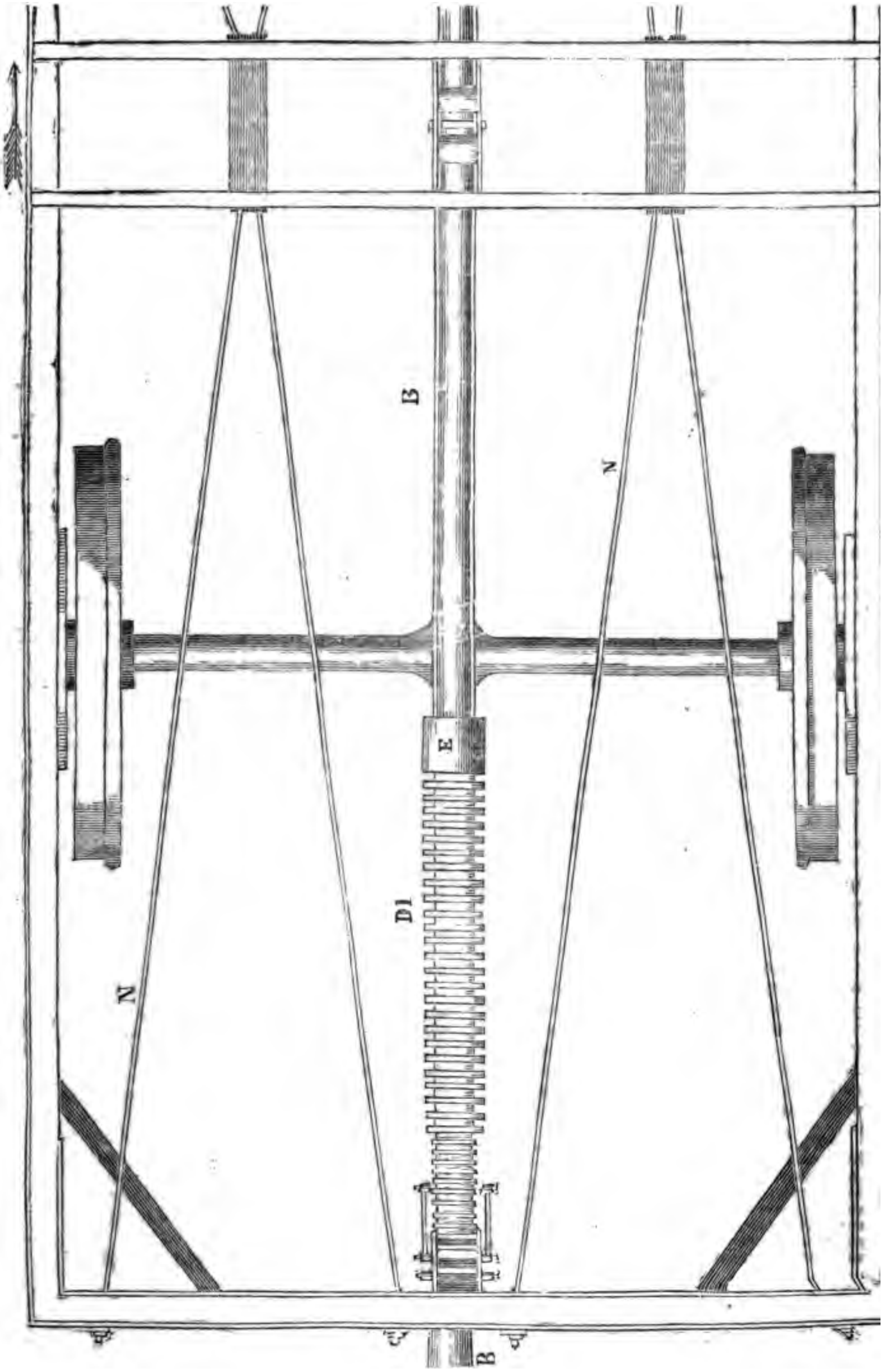
Immediately after commencing the traffic on the Liverpool and Manchester Railway (the first on which long trains of carriages were moved by locomotive-engines at high velocities), it was found that every time a train was put in motion or stopped, violent concussions took place between the several carriages, equally disagreeable to the passengers and destructive to the carriages themselves. These concussions arose from the following cause; viz. by reason of the inertia of all heavy bodies, the same engine-power which would be adequate to draw a given load along a railway at any required speed, would not be sufficient to start the same load from a state of rest; it was therefore necessary to connect the several carriages by chains of some considerable length, say three or four feet, by which arrangement the inertia of the train was as it were divided into as many parts as there were carriages, and these several parts being each within the power of the engine, were overcome in succession; but as the first carriage would have attained a certain amount of velocity when the connecting chain came to pull the second, this second must of course be at once dragged from rest into motion at a speed nearly equal to that already acquired by the first, and so on through the entire train. Now a very slight knowledge of the principles of mechanics teaches that the concussions already mentioned were the necessary result of the action described; the same principle (inertia) produced the same effects at stopping a train, and also at every change in the relative velocities of the individual carriages when in motion; and as the force of these shocks was dependent on the velocities, the greater the speed of travelling the more violent they became.

The obvious remedy for the evil complained of was to provide a means by which the full amount of motion acquired by any part of the train should be gradually, not instantaneously, communicated to the other parts; the elasticity of a spring was a suitable means, and an apparatus was accordingly added to the Liverpool and Manchester passenger coaches, a sketch of which is annexed, and which has been termed a buffing-apparatus.

[Here follows a description of this apparatus]:—

This apparatus is complex, and consequently expensive; it also requires to be very strong, as on a little consideration it will be evident that the spring-bars, levers, and frame of the first carriage have to bear the resistance of the entire train; a very rigid spring is therefore necessary, the range of action of which is, of course, very limited (in practice not exceeding a few inches), consequently the concussions, although much diminished, are still very considerable. The apparatus being attached to the carriage-frame, which is, of course, supported on bearing springs, it rises and falls according to the load; whence it constantly occurs, from the carriages being unequally weighted, that the buffer-heads, opposed to each other, and which by right should be at the same level, vary by nearly their own diameter. Whence, in the event of a violent blow, the bars to which they are fastened are almost certain either to be bent so as not to play in their sockets, whereby the whole apparatus becomes inoperative; or else to be broken off (such we have found to be the case in every instance when an unusually severe blow took place). After the apparatus described was added to the Liverpool and Manchester carriages, it was found that the train no longer proceeded with a steady motion in the direction of the rails, but that each carriage had acquired a very considerable lateral motion, by which the flanges of the wheels were constantly striking or rubbing against the rails, so as to cause a considerably increased resistance from side friction; indeed, on looking

Fig. 2.



along a train of six or eight carriages, the serpentine motion is very striking. The cause of this unsteady motion will be evident when we recollect that the point from which each carriage is drawn is in one direction, the centre, and in the other the after extremity. These considerations, the result of numerous careful examinations of the carriages on the Liverpool and Manchester Railway previous to ordering our own, led me to seek for a remedy; as on the Dublin and Kingstown Railway, so very large a proportion of the traffic of which would be passengers, the extent of which it would be difficult to anticipate, but which must of necessity be immense, it became a matter of paramount importance to attain, as far as practicable, the most perfect comfort and security, and also to reduce as much as possible the wear and tear of the numerous carriages which the company must provide. The apparatus which I designed, and which has been successfully applied to thirty-five of our carriages, is represented in plan, section, and elevation in the accompanying drawings.

A slight frame of sheet-iron, A A A, consisting of two similar plates, three inches apart, each about $\frac{3}{16}$ thick, secured together by rivets, rests on turned bearings on the centres of the axles; a single bar, B B (I have used a welded iron tube of $\frac{5}{16}$ inches thick and three inches diameter, as being the stiffest), the entire length of the carriage, and extending about two feet beyond each end, passing through an oblong hole three inches wide and nine inches long (H, 4), is supported on this frame by rollers, C C C, allowing it to be moved lengthways with great facility; on this tube or bar B B B is placed at either end (within the framing of the carriage) about four feet of spiral springs, D D D, of graduated strengths; one end of each of these sets of springs rests against a strong collar or boss, E, fixed to the bar or tube, and the other end against a small box of iron, F, attached to the frame A, and furnished with one of the rollers C previously mentioned, also with the two friction rollers G and G projecting a little beyond its surface, and resting against the inner side of the carriage-frame end. To each extremity of the tube B B is attached a buffer head, I, by means of a bar of iron, K, passing through B B, and furnished with a nut and screw at each end; immediately within the buffer-head, and resting against it, is a bar of iron, L, for attaching the carriages together. It will be observed, that this apparatus lying loosely on the axles, is perfectly independent of the frame-work of the carriage, which is supported in the usual manner on bearing springs, M M, and, in consequence of the oblong holes H H, rises or falls according to the load without affecting the buffing-apparatus. The action of the apparatus is as follows:—The train being to be moved in the direction of the upper arrow, the motive-power is applied at L 1, and draws forward the central tube B B, thereby compressing the springs D D between the boss E and the friction roller-box F, which rests against the end of the carriage-frame, without moving this latter until the elastic force of the compressed springs becomes sufficient to overcome the resistance presented by the friction and inertia of the carriage, when the latter begins to move forward so gently as not to be perceptible to persons seated therein; the second and each succeeding carriage in the train is by similar means brought from a state of rest into motion, as (altogether independent of the springs D D) the tube B B acts on B 2 merely as a simple connecting chain, rope, or bar, would. In case of a concussion from behind, or of one carriage running against another, it will be at once seen that the resistance is offered by the furthest end, the effect being to drive the tube B B forward, compressing the springs at the remote end; and the carriage will not be affected by the blow until (as in drawing the train) the elasticity communicated to the springs overpowers the inertia of the carriage, which then begins to move, actuated by a force just sufficient to start it; any ordinary velocity might be thus (theoretically) resisted by sufficient length of spring, without any strain or violence to the carriage receiving the blow, but practically the springs are limited to about four feet, allowing a range of action of about two feet, beginning to be compressed by a force equal to about twenty pounds, and presenting a gross resistance to entire compression of upwards of two tons, and which have been found sufficient for all practical purposes. It will be observed, that as the springs of each carriage act totally independent of each other, and of all the carriages in the train, except that to which they are attached. each has but to bear its own share of the resistance, the sum of which is made up of the separate resistances of all the springs acted on: thus, if one set offers a resistance equal to two tons receding through two feet, and that there be ten carriages in the train, the gross resistance to a concussion would be equal to twenty tons through two feet; and if the buffer-heads of each carriage were in contact, this great amount of

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[*] We have given the section and plan only (our figs. 1 and 2), and have omitted the after-part of the carriage-frame in each, as it is an exact counterpart in every particular of the front part. We have also, for convenience sake, given detached views of the buffer-heads, figs. 3 and 4, being a section and plan of that in the front, and figs. 5 and 6, a section and plan of that in the rear.—Ed. M. M.

resistance would be opposed without the carriages being necessarily moved forward, as in the case of any obstruction on the rails, or any of them bearing more than two tons. On the contrary, in the other apparatus, supposing each spring also to resist a force of two tons, and to recede, as is the case in practice, about eight inches, each spring being acted on by all that preceded it, the resistance offered by a train of 10 carriages would be but equal to two towns through 10 times the space each separate spring moved, or 10 × 8 = 80 inches, or six feet eight inches; consequently the first and each succeeding carriage would, to enable all the springs to act, be forced through a space equal to the sum of the spaces through which the separate springs act; thus the first carriage of the ten would be forced through eight inches for each of the remaining nine carriages, or in all six feet, and it is easy to conceive the difference of the effect in the two cases. Experiments have been tried on this railway, by placing a single carriage, fitted with the new apparatus, on the rails, and running an engine and tender against it with a velocity of six to seven miles an hour, without producing any injurious effect. I have more than once sat in a carriage so struck, without sustaining any injury or other effect greater than is felt on starting a train of carriages fitted with the old apparatus.

Another effect which has been realised by the adoption of this apparatus, is a perfectly steady forward motion in the trains, whereby very much of the side friction of the flanges of the wheels against the rails is avoided; and instead of that undulating lateral motion previously described, all the carriages constituting the train move forward in a steady path, as if they had not the power of motion independent of each other. Carriages are hereby rendered much less liable to go off the rails, and can be pushed before the engine in case of necessity with far greater confidence and less liability to accident; as although the impulse is given to the central bar from behind, yet it is obvious the carriage is acted upon from the front, precisely as it would be if drawn in the same direction. I have frequently, during our experimental trials before opening the railway, propelled one and two carriages in this manner at a velocity of thirty miles per hour with perfect safety. The diminution of side friction necessarily diminishes the power requisite to draw a train: the amount of saving in this respect I have as yet been unable to ascertain experimentally with sufficient accuracy to state in this place; I have, however, ascertained that it is very considerable.

One other object, of no trifling importance to a concern like the Dublin and Kingstown

Fig. 3.

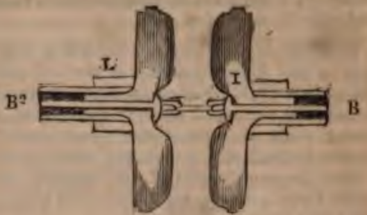


Fig. 4.

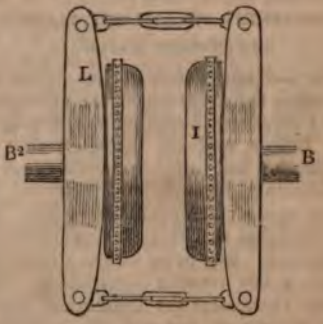


Fig. 5.

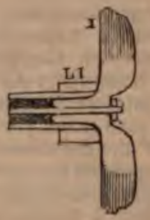
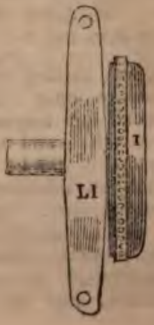


Fig. 6.



Railway, which must have an exceedingly large stock of carriages, is also effected; namely, a diminution of first cost of between 50*l*. and 60*l*. per carriage.

In describing the figures, I omitted to state that as the entire resistance to the action of the springs D D is on the ends of the carriage-frame, the centre of each is armed with a strong plate of iron, about fifteen inches square, through which pass the tension rods N N to the outer angles of the opposite ends of the frame; consequently these rods receive the entire force of the springs.

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Sir,—Some doubt having arisen respecting the accuracy of my allusion to the *Lancet* case, I applied to Mr. Wakley the Editor, and was informed that an injunction had been obtained against his publishing Abernethy's lectures, but from some circumstances in Mr. A.'s professional situation, it was afterwards dissolved. My prior information I had from a law treatise printed in 1828, three years after the injunction, giving the injunction, but not the dissolving of it.

In your remarks, p. 503, you say you incline to think "Mr. Herapath has greatly overrated the profits of the Greenwich Railway." As this may be construed into an imputation on my veracity, I shall thank you to show me in what. If the documents I consulted are to be depended on, and the circumstances contemplated take effect, I am quite satisfied I have underrated the profits.

Your obedient servant,

JOHN HERAPATH.

Kensington, Sept. 29, 1835.

[Nothing was further from our intention than to offer the slightest impeachment of our respectable correspondent's veracity; and we can hardly imagine any one would be so foolish as to draw such an inference from the language we employed. To "overrate" is certainly not to falsify nor even to misrepresent, both of which imply design; we understand it to mean simply to miscalculate, and we so used it. Mr. H. invites us to show "in what" he has "overrated" the profits to be derived from the Greenwich Railway; but as we see no utility in retracing the ground already gone over by H., we shall merely, by way of illustrating the sense in which we made use of the term, refer to the item of rent to be derived from the arches. Mr. Herapath overlooking (as we apprehend) that each arch will furnish but the end walls to a house, takes credit for as much rent as if it would form at once a complete dwelling place, fit and ready for occupation. Here, surely, there is great overrating—overrating to the extent of all the capital requisite for the conversion of the arches into tenantable messuages.

One word as to the case of Mr. Abernethy and the *Lancet*. Mr. A., if our recollection serves us rightly, was not foiled, because of any doubt as to the right of property in lectures, but because, from his habit of lecturing extemporarily, it was impossible for him to verify *the copy* of which he claimed *the right*.—ED. M. M.]

◆

THE GREENWICH RAILWAY.

Sir,—I cannot refrain from requesting a place in your Journal for a few observations on the article, "The Greenwich Railway," which appeared in the *Mechanics' Magazine* of the 26th inst. So *mutatis mutandis*, commences an extremely unique and good-humoured attack on Mr. Herapath by your correspondent H.; and so humbly thanking him for the exordium, do I commence a reply to this "honest of purpose" and "heavy of hand" gentleman, as you call him. Pray, sir, do not imagine I am one of those scientific knights' errant, who are ever ready to shed their blood, *alias* their ink, in every wrong fray, and, Don Quixote like, to come to blows with every gander that may be found hissing on the wide common of science, though in the present instance it may appear so. No, Mr. Editor, I am a plain, humble individual, whose courage this time has been screwed up solely by motives of pity for Mr. Herapath, fearing he will not attempt to stem the torrent of unanswerable argument, wisdom, candour, and truth, the "heavy of hand" has so unmercifully poured down upon him. I am the more ready for the strife, because should my courage or my strength fail me, I can retire from H.'s "hard rubs" behind the anonymous fence, unknown and undishonoured, which you have erected for poor wights like myself.

H.'s second paragraph, containing his "hard rub" on Mr. Herapath for preferring the engineer's viaduct to an embankment, is one of the most singular specimens of engineering judgment and knowledge that has perhaps ever appeared. I can only stop to notice one part of it. "Mr. Herapath decides without hesitation," says H., "on the superiority of an embankment to a viaduct." True, but he has given a reason for it, namely, that in the present case it is more economical. "But," continues H., "he appears never to have bestowed a moment's consideration on the *real question*, whether it would not have been a better plan to conduct the railway along the SURFACE of the GROUND, and so dispense with either an embankment or a viaduct." What! conduct a railway, which has to cross near twenty thoroughfares within four miles, some of them among the most thronged in Europe, "*along the surface of the ground*." We must not mistake him, and on swamps, bogs, &c.!!

Now for another example of H.'s railway knowledge. H. is here in a high furor, indeed, with Mr. Herapath's calculation of the per centage tolls the Greenwich Company may expect to receive from other Companies using their line; "amazing, indeed," "most extravagant," &c., are the hyperbolic terms applied by this excited individual to Mr. Herapath's calculations. After a long flourish on Mr. Herapath's mode of calculating the Greenwich claims on other Companies, H. triumphantly asks, "What per cent. would the Brighton Company realise if they went the whole distance on railways for which they pay a toll?" Why, if they paid a toll proportional to the cost of the railway, which is what it ought to be, a very good one indeed. For example, suppose the Brighton line cost 900,000*l*., which is the estimate, and that their gross revenue be the "500,000*l*." per annum, this will be 55 per cent. on the capital. Now, Mr. Herapath computes that the Brighton Company for half their traffic should pay a toll to the Greenwich of 2½ per cent. on the whole of the latter Company's capital for using their 2½ miles, which is 4 per cent. per mile per annum on the cost per mile. Eight per cent. per annum on the cost of construction is, therefore, the whole toll Mr. Herapath computes the Brighton should pay any other Company for making a line and keeping it in repair for them. Taking 8 out of 55, or out of half of it, would leave 47, or 19½ per cent. on the total cost of the line for finding locomotive power. If the first cost of this power be one-fifth of the capital for the line (on the Manchester it is not one-tenth), and 50 per cent. of this goes for wear and tear, then the least of the foregoing per centage will give $19\frac{1}{2} \times 5-50=47\frac{1}{2}$ for the profit per cent. per annum for finding locomotive power. Will this satisfy H.?

Mr. Herapath's communications have been, says "our oracle," "from the beginning full of misapprehensions and misrepresentations."[*] To point out the "misapprehensions," we do not require of him, because it would be like requiring Scott's Dandy Dinmont to square the circle, or discover the longitude; but if he can show any "misrepresentations," let him do it; it is right he should. To encourage him I will give him an example or two on his own part.

"Two of the arches, we are told," observes H., "are already *occupied* as five-room *private* houses." Who told him so? Mr. Herapath no where says any such thing. Again, p. 502, H. says, Mr. Herapath makes in one plan the "line of railway traverse a *beautiful country*," while in another part it is truly described as "an *unvaried* monotonous track." This is really too barefaced. Mr. Herapath, p. 451, distinctly says the "footpath," which is on the ground hemmed in by the viaduct on one side, and the boundary-wall on the other, "goes through an unvaried monotonous track," but the prospect from the elevated railway is very different. Are these specimens of "honesty of purpose?"

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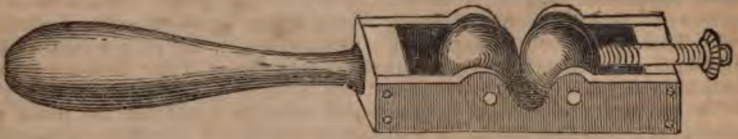
[*] We take blame to ourselves for allowing this sweeping and unsupported assertion to pass. "Misapprehensions" there may be in Mr. H.'s communications, but there is certainly no ground for describing them as full of "misrepresentations." We entirely acquit Mr. H.—as every one who knows him must do—of any wish to mislead, or to promote any other ends than those of truth and justice.—Ed. M. M.

"Most of the former letters of Mr. Herapath's series," says H., p. 500, "have called loudly for animadversion, but I think this exceeds them all;" only two pages further on this consistent individual says, "It would not have been worth the trouble to notice the paper at all, were it not," &c. There is an old adage about who should have a good memory, which would appropriately enough apply here, if H.'s every paragraph and almost every line had not an equal claim to it.

ANTI H.

Sept. 30, 1835.

EXPEDITIOUS RAZOR-SHARPENER.



Sir,—It occurred to me, that by fixing in a frame two smooth steel balls, in contact, the finest possible edge may be given to a razor, by drawing it between them. I proposed this contrivance to Mr. Gills, a very ingenious cutler of this city, and requested him to make me such an instrument. He objected to the difficulty of turning the balls, which, I therefore, procured at Mr. Stothert's foundry. The balls are of cast-steel, three-fourths of an inch in diameter, with a hole drilled through the centre of each. The mode of fixing them in a frame I left entirely to Mr. Gills, by whom the screw was added for the purpose of keeping them in contact. This screw, also, affords the additional advantage, that if the pivots are suffered to be a little loose in the frame, the balls may be turned and again fixed. The same objects may be attained by more than one plan; but this, adopted by Mr. Gills, seems to admit of no improvement. The balls are made as hard as possible, and polished in a direction opposite to that of their axes; whether a perfectly spherical or an oval figure would be the best, is not ascertained. The handle is made of ivory, and the frame of brass.

Upon a short trial, by myself and others, this instrument promises to give an exceedingly fine edge to every description of cutlery for which such an edge may be required. The mode of using it is to draw the edge of the razor a few times, perpendicularly, with a very light or moderate pressure, between the balls. It is, however, essential, that a mixture of putty-powder and oil, about the consistence of very thick cream, or putty-powder and mercurial ointment, or some equivalent substance, should be placed between the balls, forming a sort of bed, through which the edge of the instrument is drawn; it should afterwards be strapped on the hand. This process may be resorted to as often as the edge of the razor becomes dull—once, twice, or three times a week—and I have found that an exquisitely fine edge may be thus produced in a few seconds. Of course, no instrument would be suited to this mode of sharpening unless it had previously a thin edge.

This instrument, though a modification only of the table-knife sharpener now in use, has a different action, produces a different edge, and is, therefore, applicable to a different purpose. It is superior to Mr. Knight's razor-sharpener in this respect, that both sides of the edge being acted on equally, and at once, the edge may be compressed; it is, also, kept in the centre, and is liable to be neither bent nor broken. But it seems to combine the principles and advantages both of the table-knife sharpener now in use, and of Mr. Knight's steel.

I am, Sir, your obedient servant,
D. Pring.

Bath, Sept. 24, 1835.

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HALLEY'S COMET.

(For the Mechanics' Magazine.)

The following ephemeris of the comet, during a fortnight of the most interesting part of its appearance, is computed from the same elements as used in the *Nautical Almanac*, adding only 9½ days to the epoch of perihelion. This makes a very material alteration in the apparent path, as I have already had occasion to observe. The places are given for midnight.

Date.	Rt. Asc.		N. Dec.		Distance from the Earth.
h.	h.	m.	°	′	Miles.
Sept. 29, 12	6	33·7	36	15	53,470,000
Oct. 1, 12	6	42·4	38	48	47,204,000
—— 3, 12	6	55 0	42	9	39,783,000
—— 5, 12	7	14 7	46	43	33,254,000
—— 7, 12	7	50 2	52	56	27,190,000
—— 9, 12	9	6·0	60	31	21 986,000
—— 11, 12	11	50·	63	54	18,449,000

I regret the absolute necessity of postponing my further elucidations on this subject until next week, having had only just time to make the above calculations.

J. W. Woollgar.

Lewes, Sept. 30th, 1835.

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ON THE PROPER DEFINITION OF THE TERM SCIENCE—AND TRAINING THE VINE.

Mr. Editor,—There is no class of society more interested in the establishment and diffusion of science than that to which your Magazine is professedly devoted; but what is science? Although no one may be found to deny that correct and clear definitions are the foundations of science, yet so varied and inconclusive is the term science itself, that, although in every person's mouth, few attach to it the same meaning. Then thinking as I do that the definition of Aristotle is not only sufficiently comprehensive, but calculated to do away with a great deal of mysterious cavilling, and absolutely necessary to explain to artists the only means by which they can attain the mastery of their arts—I will, with your leave, follow up this preface to my observations by what I conceive to be the proper definition of the terms theory, art, and science. It is an axiom, that every production of nature and of art is the effect of some cause; consequently, before any effect can be produced, the cause must be established—and before any effect can be prevented, the cause must be removed—and before any person can undertake with any certainty to establish or remove the cause of any effect, they must know what it is; and a knowledge of the causes of effects is science. Every person contemplating the production of any effect, readily suggests the cause, and such suggestion forms theory. Theory, then, although the work of the mental faculties, is a mere hypothesis, and may be true or false. But if this theory be put to the test of practical and ocular demonstration, and proved to be true, the knowledge of it then becomes science. Science, therefore, is a knowledge of truths demonstrative. As the primary causes of all effects are certain elementary principles established by nature, and brought into action or rest, and made to exist in a separate or combined state, by certain laws of nature—to make the necessary demonstrations, to establish the truth of any theory, the required elementary principles and laws of nature must be brought together and sustained, which requires the aid of the muscular powers, and the exertion of these constitutes art. Science, then, is the progeny of theory and of art, the result of the combined action of the mental and corporeal powers, the essence of both—and, of consequence, the most valuable of all knowledge. If such be the admitted definition of science, it must be obvious that the only certain means by which a person can become master of any art, is to study and comprehend the science of that art; for until this knowledge is acquired, a person must be working in darkness and uncertainty, and can be little better than an imitative piece of machinery.

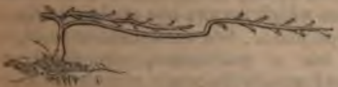
In corroboration of the justness of my estimation of the value of science, as here defined, I will beg leave to state, that very early in life I possessed a taste for the arts of horticulture and agriculture; and although not so circumstanced as to follow them with a view to pecuniary advantage, perceiving that the principal operations of gardening and farming were performed in ignorance of the science, I made the study of this my principal amusement. The arts of horticulture and agriculture having been followed by the most illiterate class of society, they have been always ranked in the lowest grade; and obvious enough it is, that as no artists were more ignorant of the science of their arts, no art could deservedly be placed below them in mental estimation; but the successful practice of those arts, like all others, must depend upon their science, and as the productions of no other arts administer more to the comforts of mankind, nor indeed are more necessary to their existence, no art can be more useful. And as the science of horticulture comprehends a knowledge of the elementary principles of which all things are formed, and a knowledge of the laws of nature which govern and determine the growth and productions of vegetables, the study of it not only produces that refinement which leads us to the admiration and enjoyment of the greatest beauties of nature, but, as it leads us to

> "Look through nature, up to nature's God,"

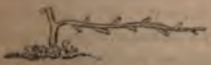
it raises us above all grovelling and degrading means of occupying our minds and bodies; and, taken in this point of view, that which was ranked the lowest among the arts and sciences, may justly be placed above the highest.

I have been induced to offer you these observations, by the letter of Mr. Watson, in your No. 611. Not having seen Hoare's work, I know not whether he has explained the science of his art; but if he has not, however simple may be his process, or mode of managing the vine, many who may attempt to follow his plan will fail. As before observed, the causes of all effects, over which we have any control, are certain elementary principles established by nature, and which are brought into action and rest, and made to exist in a separate or combined state by certain laws ordained by nature. Now, although we are not permitted to know or to understand what the principle of life in animals is, we know how to establish it, and how, to a certain extent, to sustain it; and a knowledge of the means of establishing the life of vegetables and of sustaining it, is as much within our power: thus, we know that to establish the principle of life, or to generate a new plant, a junction of the sexes is as necessary as it is with animals, and the health and productive powers of plants as much depend upon a supply of food as do those of animals. Hence it will always result, that whether a plant shall be barren or fruitful, or whether its fruit be of good or bad quality, will be determined by the quantity and quality of the food supplied by the soil; therefore a knowledge of the causes of barrenness and fruitfulness of plants and trees, must include a knowledge of the elements of the food required by them, and of the soil best adapted to the production and preparation of such food. To explain this part of the subject would be intruding too much upon your room; but as, by the laws of nature, the mode and manner of fructifying are made different in different plants, the mode and manner of pruning which would promote and sustain fructification in one kind, will produce a contrary effect in another; and the habits and mode of fructification in the vine being different to that of any others of the fruits in general cultivation, I will state the laws of nature which regulate and determine the growth of the vine, and without an understanding and observance of which, a vine cannot be properly trained, or, so as to make the most of it.

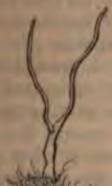
1*st*, The vine bears its fruit on shoots or branches of the present year, produced from branches of the last year's growth. 2nd, The strongest and best ripened branches of the last year produce the most fruitful the present year. 3rd, The strongest shoots of the present year are always produced at the extremities of the last year's shoots, whether such shoots be left long or short, and whatever be the position of the branches, whether horizontal or vertical. And, 4th, The greatest quantity and finest quality of fruit will always be produced on those branches that are at the greatest distance from the roots. Supposing, then, we begin with a young plant; the better plan will be to cut it back within two or three eyes of the stem or base from whence we wish the fruiting to commence; every year, leaving two shoots only to grow, until they are strong enough to bear fruit, which will not often be, in less time than three years from the time of planting. The plant at the end of the year will then be like this:—



At the winter pruning it should be laid thus:—



The branch being placed horizontal, and left from three to nine feet in length, will produce bearers at every eye; the other branch to be shortened to three eyes, two of which will produce strong shoots for next year: these shoots must be suffered to grow unchecked their full length; the bearers to be stopped at the second joint above the fruit; the shoot at the end of the long branch to be also suffered to grow its full length. At the second winter pruning, all the old bearers being removed, and the strong branches brought down into their proper places, the tree will then be as thus:—



And the same plan being adopted, and the same rules followed, the same space of wall may be covered with fruit every year to a great extent. It must be observed, that by following this method, a wall of eighteen inches high only, will not only ripen fruit in perfection, but when the vines are thus trained so near the earth, the fruit will ripen from ten days to a fortnight earlier, than four feet high on the same aspect; and as a wall of this height will not cast its shadow far enough to obstruct the desired effect of the sun on another wall parallel with it, a great quantity of grapes may be grown and ripened to perfection on a very small surface of ground. As a more minute description would occupy too much of your valuable columns, perhaps you will allow me to refer such of your readers as may wish to study the science of horticulture, to a little book I have just published, as a catechism of those sciences.*

And am, Sir,
Your humble servant,
J. Hayward.

Lyme Regis, August 10, 1835.

ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—The re-appearance of Halley's comet has recalled a subject to my mind that has, at intervals, occupied my attention for the last fourteen or fifteen years; and in a work which I am now preparing for the press, I hope to be able to adduce satisfactory evidence in support of the following propositions:—

1st. That comets are immense volumes of aeriform matter discharged from the sun by the agency of electricity.

2d. That comets are gradually condensed, and eventually become planets.

3d. That planets move in spiral orbits, and ultimately fall back into the body of the sun.

And, as a corollary of the foregoing, that the moon is slowly approximating towards, and will ultimately fall upon, the body of the earth.

There are a variety of concurring circumstances which tend strongly to prove that the sun is a vast spherical conductor, highly charged with electricity, and that his electric influence extends to the utmost limits of the planetary system. The internal action of the sun is so intense and violent, that it cannot possibly be effected by other than electrical agency; and as we are assured by experience, that whenever there is violent internal action there is a strong tendency in the body to deliver itself of the cause of this action, it requires no very great stretch of the imagination to conceive the sun capable of expelling a volume of aeriform matter of much greater magnitude than any comet that has hitherto appeared in our system. The emission of a comet may be regarded merely as a spark drawn from the prime-conductor of the solar system. We have no direct evidence of comets having been discharged from the sun; but, in the absence of this, we have the inferential proof of their having been seen receding from that body, whilst their approach had not been noticed by the most careful and diligent observers of the motions of the heavenly bodies. The probability of comets having been originally discharged from the sun by the agency of electricity being admitted, all the other points of this theory follow each other in an order so plain, so simple, and so obvious, that the meanest capacity may comprehend them.

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* See Advertisement.

The sun attracts the earth, and all the planets and comets in the solar system, in a ratio corresponding with the solid contents of matter contained in each respectively; and, at the same time, repels them in a ratio corresponding with the quantity of electric fluid with which each is charged. By this law we are enabled to explain with facility the cause of the motion of comets and planets in their orbits, the ebbing and flowing of the tides, and various other natural phenomena, which have hitherto remained inexplicable. Indeed, when the principles of this theory are well understood, the conclusions press themselves upon the mind with a force that cannot be resisted. It would be impossible in a communication of this description to enter into any detail upon all the different points of this theory; I shall, therefore, confine myself to the tides, as this is a matter that comes under our immediate notice, and is an effect with which the inhabitants of this part of the world are well acquainted.

It has been long known that the ebbing and flowing is, somehow or other, caused by the moon, although the explanations hitherto given upon the subject are very confused and imperfect; even Sir Isaac Newton's explanation, which is certainly the best, is very far from satisfactory. At new moon, that is, when the sun and moon are both upon the same side of the earth, there is a spring-tide. Now, the Newtonian explanation of this is, that the sun and moon acting in conjunction, their united attractions on the same side of the earth cause the tides to rise higher than at other times when they are not in conjunction. This is plain and easily understood, as far as it goes. But there is a spring-tide on the two opposite sides of the earth at the same time; and if we attempt to discover the cause of the full-tide on that side of the earth which is removed from the sun and moon, we get completely bewildered. The Newtonian philosophy furnishes certain words and phrases by way of explanation, the meaning of which no one has yet been able to comprehend. We cannot understand, by the law of gravitation, why the moon should attract the ocean at 240,000 miles distance, and repel it at the distance of 248,000—this seems a paradox.

Now let us examine the tides by the electrical theory. It is found by experiment with the electric machine—

1st. That two bodies positively charged, repel each other.

2d. That two bodies negatively charged, repel each other.

3d. That two bodies, the one positively and the other negatively charged, will attract each other.

There is an electrical law called the law of induction, which must be clearly understood before we attempt to explain the ebbing and flowing of the tides. In a metal ball positively charged the electric fluid is found to be uniformly distributed over the surface; also, in a second ball, containing its natural quantity, the fluid is found to be evenly distributed. But if the first ball be presented to the second, *without touching it*, the fluid is repelled to that side of the second ball farthest removed from the first; if the second ball be composed of two parts, and the remote part be removed, it will be found that nearly the whole of the fluid is contained in that part, and that the part which remains is nearly empty, or in a negative state, and, consequently, the first ball will attract the negative part and repel that which is positive.

The explanation of the ebbing and flowing of the two tides on opposite sides of the earth at the same time, is almost too plain to require any farther remark. We know that the earth is charged with electricity; and we may feel assured that the moon is charged in the same manner. Now, the sun and moon inducting the earth both in the same direction, produces an effect exactly similar to the two balls; that side next to the sun and moon is rendered negative by their inducting influence, and, consequently, a tide is caused on that side by their united attractions; whilst the earth's electricity is repelled to the remote side, and causes the opposite tide. All the other phenomena connected with the tides flow so plainly out of this principle, that I shall not pursue the idea farther at present.

I shall probably at some future time trouble you with a few remarks on the moon's approximation towards the earth. In the mean time,

I remain, yours, &c.

THOS. SIMMONS MACKINTOSH.

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MR. HICKS'S PATENT GAS-COOKING APPARATUS.

Sir,—My attention has been called to a notice that appeared in your Magazine of Sept. 12th (No. 631), of a method of cooking by gas, which is clearly the same as that described in No. 495. The superintendent is stated to be a Mr. Barlow, a gentleman of the same name as the one whose letter appeared on Sept. 5th, and who is also the author of the notice in No. 631. But I have been very much surprised that in those communications the name of Mr. Hicks has not been once mentioned, as he is the patentee of this invention; and I think a similar feeling of surprise must have arisen in the minds of every one who remembers the very just article inserted by you in No. 495, and the farther remarks of Mr. Loudon in No. 521, which clearly establish that any one making or selling apparatus for cooking by gas with an *envelope* must be infringing on Hicks's patent. I am not only justified, by information that I have received and can produce, in saying that such infringement has been committed, but your Magazine itself furnishes several instances, which I will refer to in due course. Great pains have been taken of late by certain parties to spread abroad a notion that cooking by gas is not the subject of a patent, and thereby to persuade the public to commit an act of injustice, which I feel confident they would abhor were they acquainted with the truth. Now, as I am a shareholder in the patent in question, and have also the sole right of manufacture, I consider that it is but justice to myself to state that such persons are violating my right; in short, they are committing nothing less than piracies upon the patent. I am now about taking legal steps to stop such proceedings. I do not consider that I am called upon to explain why I have not protested against this before, or prevented such parties from continuing their piratical practices; but after the two communications which have just appeared in your Journal of Sept. 5th and 12th, I am determined not to lose another moment in so doing, and I feel confident that you will not object to insert my protest against conduct which is most unjust and unmanly.

I need hardly state, that I am one of your constant readers, and have always considered you to be the strong advocate of fair reasoning and correct dealing; I know, too, that you have often proved a terrible check to impostors and unfair dealers. Neither you nor the public in general will, I am sure, in the least discourage me from maintaining my rights; and as the extensive circulation of your Magazine renders it accessible to all classes in all parts of the kingdom, I trust this may be the means of causing some of the marauders in question to desist from practices which cannot be called any thing but dishonest. Indeed, I am convinced the public will feel an utter abhorrence of the conduct of such paltry pretenders to an invention of which probably the whole of their knowledge has been gleaned from your pages. I will not intrude upon your space, and the time of your readers, with any illustration of the beauty and simplicity of the invention, after the able elucidation penned by Mr. Loudon, which was so perfectly satisfactory to Mr. Hicks and myself, that we did not consider it needful, after that had appeared, to send any other communication to you on the subject, as we had previously contemplated.

In the letter of Mr. Barlow, which appeared on the 5th of September, he states that Mr. Sharpe furnished him with his apparatus for 5*l.*; but I have been informed that the name of "Josse, of Regent-street, agent to the patentee," is upon the apparatus at Mr. Barlow's house at Islington. What, then, is the reason for Mr. Sharpe putting Mr. Josse's name upon his apparatus; and how can Mr. Barlow assert, that it is not a patent when his apparatus has upon it "agent to the patentee?" It has to me rather an underhand appearance, let it be whose patent it may that he is making use of. I am very much inclined to think that Mr. Barlow and Mr. Sharpe are most intimately connected in this affair, though I have understood he (Mr. Barlow) asserts the contrary. At all events, I think nothing can be more clear than that both he and Mr. Sharpe are grossly infringing on the patent. They are not only acting with extreme unfairness as regards the patentee, and those that are connected with him in the way of licenses, &c., but they are deceiving the public by endeavouring to make them believe there is no patent in the case. It highly behoves all who contemplate introducing this apparatus into their houses, first to satisfy themselves that those parties who furnish them with it are authorised to do so. As to Mr. Sharpe's going to church on a Sunday, we all know that church-going and correct dealing do not go invariably hand in hand. He applied to me to grant him a license for manufacturing and using the patent apparatus in Northampton, but we did not come to terms. How he can, after this, manufacture and sell it, and with such publicity too, at the same moment that he talks of locking up his house and going to church, astonishes me beyond every thing.

These remarks may appear severe, but I have made such inquiries as fully warrant my assertions, and I can substantiate them by witnesses. Mr. Barlow states, that such is the present demand for apparatus, that "by another summer no doubt thousands will be in use." I suppose he means it to be understood that such has been the demand, either of him or Mr. Sharpe, and, therefore, they are endeavouring as widely as possible to injure me; and, at the same time, they would make it appear that Mr. Sharpe is the sole manufacturer, and that no such patent as Hicks's patent ever existed. They seem also to infer, that there have been a great many already made—of course by them. Does Mr. Barlow mean to question the originality of the patent, when he states that he knows "of one family who for *several years* have never lighted any other fire for any other purpose whatever than gas during the three or four hot months?" He should have informed his friend, Mr. Sharpe, of this before Mr. Sharpe applied to me for a license. If he can prove the patent not to be original (which idea I laugh at), Mr. Sharpe and he may go on as they please; but I would just say, that among all the notices respecting it that have been published in your estimable journal, and others, nothing has ever appeared at all touching *its* originality and validity, and there are *plenty of persons who would long ago have discovered any such defect as this.* One of the Birmingham Gas Companies (and Birmingham gentlemen, Mr. Editor, are not the least shrewd in the world), offered 100*l.* for the license to use the patent in their district, but Mr. Hicks thought that offer was not equal to the value of it. I have, besides, had the honour of supplying the Imperial Gas Company with a number of apparatus; the Phœnix, and numerous others, at Brighton, at Grantham, at Woolwich; also that at Stroud, which was used for cooking a public dinner, alluded to in your Magazine, No. 536. So that sufficient publicity has been given to have opened the way for any one to dispute the originality of the invention, could this be done; but no one has ever even hinted at such a thing.

There is another circumstance which tends to prove that the apparatus spoken of by Mr. Barlow is Hicks's patent. In the extract from the *New York American*, your readers will perceive that the apparatus there described agrees almost verbatim with Mr. Loudon's description in No. 495, which I have before alluded to. Now it must be very evident, from what has already appeared in your Magazine, that Mr. Barlow in England and Mr. Barlow in America are connected, and therefore we may conclude that the apparatus used by the one is the apparatus used by the other. I have plenty of other evidence to prove this if required, but this must be self-evident.

As to Mr. Mallett, I shall leave him in the hands of Mr. Loudon and your able correspondent Mr. Rutter, from whom I think he has received sufficient hard knocks. I would, however, just remark, that Mr. Mallett's communication was made more than two years after the patent was sealed; and, it is more than probable, that the patentee and myself commenced our experiments long before Mr. Mallett ever thought any thing about it.

I would just hint to Mr. Rutter that, in his article on the imperfect combustion of gas at a blue flame, I think he should have stated the quantity of gas consumed in each experiment with the thermometer, for I do not consider that there is an imperfect combustion at a blue flame, but that it arises from the absorption of caloric at that point where it is in more immediate contact with the metal, which is again given out by radiation, and the combustion is, nevertheless, perfect. I would suggest, that the more efficacious way of performing the experiment would have been to place a vessel containing some fluid as water, oil, or mercury, over the flame, and then to have noted the points of temperature that it was brought to by a given quantity of gas burnt at different heights. Had Mr. Rutter tried it this way, I think he would have found no want of economy, but otherwise.

It may be urged that Mr. Hicks should have made this communication, but as he is out of town he cannot at present correspond with you on the subject; and though I should have been pleased to have had Mr. Hicks's signature added to this, as a confirmation of my statements, yet it is not at all necessary or required, for as I hold the right of manufacture for certain considerations and on certain conditions, which I do not consider I am at all required here to make public, I am the person that is most affected by these piratical impositions. I may add, that in case of any legal proceedings, my opponents will find I have quite sufficient power to do myself justice, though I must say that it is very hard there are persons who would drive me to such steps.

I am, Sir,
Yours respectfully,
J. T. Beale.

11, Church-lane, Whitechapel,
Sept. 24, 1835.

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PRINCIPLES OF RAILWAY LOCOMOTION.

Sir,—The writers on dynamics have demonstrated, that the force just necessary to prevent a heavy body from rolling down a smooth inclined plane (abstracting friction) is $\frac{a h}{L}$, where a is the weight of the body, h the height of the plane, and L its length. This theorem is universally true, whether as respects our earth or any other of the celestial bodies. But in determining the space, time, velocity, &c., in and with which a body moves down an inclined plane, or when projected up a plane, it has hitherto been found absolutely necessary first to ascertain experimentally the value of the symbol g, which means the measure of the force of gravity or the velocity a body has acquired at the end of the first second, the motions commencing from a state of rest, and the direction being in a vertical line; and from thousands of experiments, the value of g in our latitude has been found to be $32\frac{1}{6}$ feet. I observe, however, in No. 618, your scientific correspondent, Mr. Herapath, has attempted, without the aid of g, to give us some very important formulæ on the principles of railway locomotion; I say important, if they shall turn out to be true; but on this point I must confess that I have some misgivings.

Mr. Herapath says, "that he has determined three rules as simple and correct as he believes it is possible in the present state of our knowledge to make them." Then follow the three formulæ (see p. 182, col. 2, and 183, col. 1.) Mr. H., himself, however, seems a little puzzled at the result of the expression $\frac{30}{1 \pm \frac{h}{22}}$, which represents the speed in miles per hour when the load is moving up or down the plane. For, as he truly observes, "we can hardly apply this formulæ to descents unless they be very small; for if the descent was 22 feet per mile, it would make the velocity appear to be infinite," &c. No doubt the formula produces such a result; and it is rather surprising that when Mr. H. found this was the result, he did not take it as a warning that there might peradventure be something wrong in his formula. An infinite velocity is no joke, and, perhaps, might be attended with *some* danger. Let us assume $h = 21\frac{1}{2}$ feet (and on this supposition gravity will not do all the work); the velocity in this case will be 1,290 miles per hour (quick enough, no doubt, for any *ordinary* purpose). Again, by assuming $h = 22\frac{1}{2}$, the velocity will turn out to be negative at the rate of 1,320 miles per hour. A negative speed, although perfectly understood by algebraists, may to some of your readers, who do not rank as such, require some kind of explanation. For their benefit, here it is. The carriage and load, instead of moving down the plane, as might be expected (as gravity in this case does something more than the whole work), will, to the utter surprise of every one, roll up the plane at the rate of 1,320 miles per hour!

Perhaps, however, Mr. H. meant that when h is greater than 22, the formula $\frac{30}{h}$ assumes the form $\frac{30}{\frac{h}{22}-1}$. But upon trial, this change will not much mend the matter. I am afraid the formula will not be exactly true, except in the case when $h = o$. Mr. H., it is true, may say that the resistance of the air will prevent any thing like a velocity of 1,290 miles per hour. No doubt, if we had 30 square feet of opposing surface, and when the resistance of the air approaches "nearly to 344 horses' power," it would certainly be a very great check upon the velocity. Again, Mr. H. may state that he has premised that the value of h must be very small; I know he has said so, but in answer to this I beg to state, that he has not given the greatest limit of h, so that we may know when his formula presents a true or a false result. With respect to his formula as it regards ascending planes, although it does not present such seeming absurdities, still, being derived from the same suspicious source, no faith can be placed in its accuracy.

I am well aware, Mr. Editor, that Mr. H. is considered by many to be both a mathematician and a philosopher of the first order; I well recollect the challenge he gave to the Royal Society on some physical questions, backed by a wager of 1,000*l.*; still, notwithstanding all this, I maintain that his algebraical formulæ on railway locomotion are not founded upon true principles.

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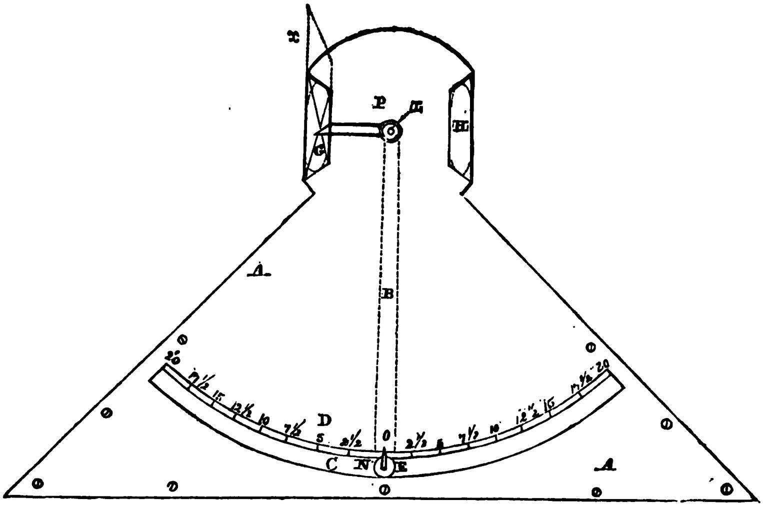

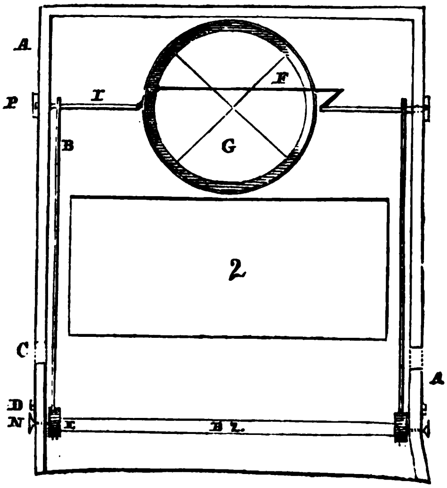

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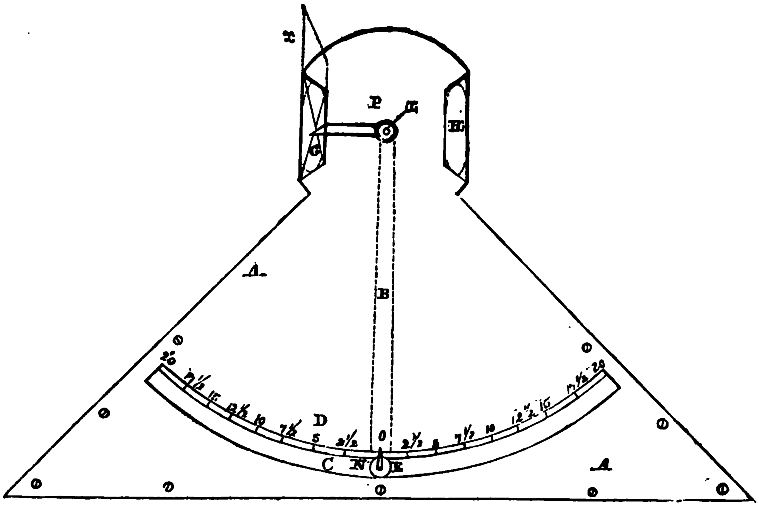

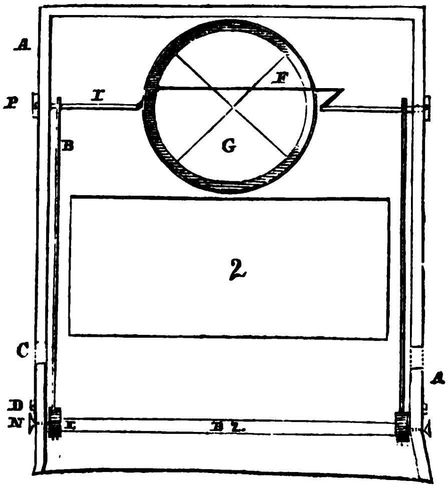

dicial Committee of the Privy Council, and notice shall first be *by him* given to any person or persons who shall have entered such caveats," &c.

BY HIM! That is to say, BY HIS MAJESTY!!! This may, without punning, be fairly called the *crowning* grace of all.

Whoever was the framer of this Act—whether the great "Schoolmaster" himself, as his own speeches would lead one to infer—or the Mr. Earle whose claims to its paternity are noticed in the *Mechanics' Magazine*, No. 632—or the egotistical Attorney who, unmindful of the superior pretensions of his "friend Brougham," goes about the town calling it "My Bill"—there is probably no one of literary rank above that of a hedge-school second-*turf* boy who will envy any of the claimants the honour of its composition. The blunders here noticed are only a few of the more glaring; the whole Act, from beginning to end, is an offence against *good*, if not Parliamentary, language. Some of the blunders pointed out reach beyond the grammar of the Act to its very essence, such as that regarding the notice required to be made by his Majesty, which will, in all probability, prove fatal to the entire provision for prolonging the term of patents; and all are of a most inexcusable description. Haste may, perhaps, be pleaded; but what occasion was there for haste? The Act was not called for either by the general body of inventors, or by any considerable section of them; it was thrust upon them without counsel with, and (apparently) without any care for, them. Some two or three holders of patents may perhaps, for private ends of their own, have been stirring in the matter, but there was nobody pressing whose motives for pressing would bear the light. *Not a single petition* in favour of the Act was presented to either House; and though it is equally true that there was no petition against it, this is by no means equally surprising—for certainly there were many more than the Editor of the *Mechanics' Magazine* who took it for granted that an Act so bad in substance, and so mis-shapen in point of form, would never be suffered by a *reformed* Parliament to pass into a law.

JURIDICUS.

Gray's-Inn-square, Sept. 25, 1835.

ON RAILWAYS. BY JOHN HERAPATH, ESQ.

NO. XII.

The Greenwich Railway.

Never, perhaps, had any concern so many and so implacable enemies as this. Whether it arises from anger at having allowed it to slip so easily through Parliament, or from the prospect of its being one of the most profitable railways out of London, I am unable to determine; but certain it is, that the more its merits are developed, the more inveterate becomes their hostillty towards it. For my part, I care not whether the Greenwich Railway prospers or fails, but I cannot help being amused at the Lilliput rage its enemies betray at the rapid advances it makes in public opinion. They remind me of the flock of Tomtits, which being offended at the lofty port of the Andes, resolved to kick them down.

In the brief observations I have made on this railway in my 2d and 10th Numbers, there are one or two matters which, in justice to the engineer, I now wish to correct and supply. Presuming the line would be constructed in the way in which railways usually are, I have in my 2d Number remarked, that a railway only four miles long could effect little in the way of speed, and would, at the same time, wear and tear itself and the engines disproportionably great. These objections have, in a great measure, been removed by the engineer having adopted the principles of elevating the termini recommended in my 5th Number, p. 235, not, indeed, at my suggestion, but at his own; for his plan was prior to the publication of my article. From the construction of the line, if the engines do barely the work of the road, gravity alone will give a velocity of 15 or 16 miles an hour in starting from Joiner-street; and there might easily be added 5 or 6 more by a proper management of the bridge terminus. Again, in returning from Deptford, Colonel Landmann has so planned his line, that, under the circumstance of the engine merely balancing the friction, gravity would furnish a velocity of about 24 miles an hour. It is hence obvious, that every circumstance has been taken advantage of to reduce the wear and tear and ensure a maximum speed.

As to the line beyond Deptford, I apprehend the levels of it are not yet fixed on, but necessarily kept in abeyance until another object is settled.

A plan, I understand, is likewise to be adopted in travelling on the Greenwich line, which will contribute still farther to obviate any objections to interruptions on so short a line. In the Manchester and Liverpool Railway, passengers going only to Newton, Warrington, or other intermediate places, mix indiscriminately with those going right through; but here they intend to have separate carriages, arranged in the inverted order of the places they are going to. Pulling up to set down will, therefore, be merely partial. "This may do very well for setting down," observed a gentleman to me, "but how will they manage in taking up on the road?" I have not heard of any particular contrivance intended to be followed, but it is clear there is very little more difficulty in the one than in the other. If the carriages are ready loaded, they may for short distances be propelled before the engine in the order of the places, without the train actually pulling up. Many simple methods may, indeed, be contrived to prevent, in taking up, the train's actually stopping. But, assuming the train must stop for taking on fresh carriages, if we consider that stage-coaches very often change horses in 40 seconds, 15 to 30 seconds will surely be enough to hitch on a train already loaded.

Rent of the Arches.

I am sorry to find that I have been so unfortunate in my statement of the profits to be derived from the rental of the arches, as to be misunderstood again and again by so acute an individual as the Editor of this Journal. Nothing more is wanting to convince me that my mode of expression, to say the least of it, is obscure and faulty. I shall, therefore, now endeavour to make myself better understood. It was stated that there were reckoned to be about 1,000 arches, which were computed to let at 30*l*. per annum each; but in order to keep within the mark, I took 900, and allowed them at 20*l* each, thus reducing the rental from 30,000*l*. to 18,000*l*. This I again afterwards reduced to 16,000*l*., thus leaving a rental of 14,000*l*, out of which I thought my readers would see that *an interest for any capital needed for fitting up those houses might be found. I will not, however, rest on this vague sketch, but go* a little more into the details. It will be observed, that I have taken credit for 16,000*l*. per annum, the interest of the railway capital at 4 per cent., that is, supposing 900 houses about 17*l*. 15*s*. 6*d*. per house. Now, from what I have seen of the two private houses, I do not think it would take 100*l*. per house, one with the other, to complete them, there being already the chief walls, roof, upper ceilings unplastered, and main drains finished; and I think the houses would then honestly average 25*l*. rent per house, that is, 5*l*. less than others expect. Consequently, there is 25*l*.—17*l*. 15*s*. 6*d*.=7*l*. 4*s*. 6*d* per cent. per annum for the remaining outlay. I hope this cannot be called overrating. However, I confess it is the Company alone that ever can and will make the outlay; they have a stake and stimulus which no other party can have. It would to them be not 7 but 25 per cent. return.

Elevating the Footpath.

I must here not omit to plead in some measure guilty to the objection raised by two fair critics to my plan of elevating the footway to about a level with the railway. One of these ladies, in a letter from Bath, filled with the most good-humoured and pertinent observations, very naturally asks, "what would become of the *arch*-shopkeepers if the path was raised above their heads?" Led away by the loveliness of the prospect from the railway, as gentlemen frequently are by the loveliness of other objects, I admit to my *arch* critic that I had considered the question a little too much in the abstract. However, it is to be observed, that the extremes near London, Deptford, and Greenwich, will generally be occupied for shops, offices, and places of business, and the middle of the line for private houses, to which it will be of little consequence whether the promenaders go above or beneath them. For many obvious reasons, therefore, this would tend rather to increase than diminish the revenue I have computed.

Principles of Railway Transit.

Although it is contrary to my general principles to reply to observations made anonymously, or under a fictitious signature, yet, as a correspondent, Iver M'Iver, seems in a friendly spirit to require explanation, I shall add an observation or two for that purpose. If this gentleman will attentively read what

I have written, he will find, that the theorems are based on the principle, that the opposing forces—namely, gravity and friction on one side and steam power on the other—are in equilibrio, not one in excess of the other; and, consequently, that the acceleration and retardation Iver M'Iver presumes, has here no existence. The effects of changing the velocity, by changes in the inclination, are in the present instance supposed to balance each other; and the extra times in getting up and losing the velocity at the termini are likewise neglected, because the conditions for their determination could not well be taken into account in the general estimates of the expense and time of transit. He will also find that the formulæ are not given as mathematically, but practically true, limited in the application, not from any defect in them but from other considerations, to practical ascents, and to such descents as full steam can be applied to with a safe velocity. That there are other matters to be investigated to render the subject complete, and which, had not various causes interposed, I should before now have taken up, I admit, but the want of them does not disturb the general accuracy of the theorems I have given as rules of computation. My object has been to simplify the theory of locomotive transit as much as I could, and to reduce one or two points in that theory to calculable rules, which I apprehend the ordinary principles of science could never have compassed. Whether I have succeeded or not, experiments alone can determine. I cannot say I have any apprehensions on the subject; but, instead of discussion, I should be happy to see an extensive series of experiments undertaken. These would do the cause of locomotion a real good, whatever they prove or disprove.

JOHN HERAPATH.

Kensington, Oct. 1835.

* * *

ON FIRE-PROOF BUILDINGS. BY MR. CHRISTOPHER DAVY, ARCHITECT.

(In continuation from last vol. p. 500.)

Lord Stanhope's method of "double underflooring" is very similar to that described in my last communication. The fillets and short pieces of laths are laid and fixed precisely in the same manner, but the coat of rough plaistering is not recommended to be more than half as thick, as that applied in the method of "single underflooring," because a layer of plaister is, in the present case, spread upon the top, upon which is bedded another series of laths as before; a coat of the same kind of plaister is afterwards spread and well trowelled upon the top of the second series of short laths level with the top of the joists, and, it is stated, that the sooner done the better.

The following observations are equally applicable to "single and double underflooring."

Common coarse lime and hair may be used, but it is considerably cheaper, and even better, in all cases, to make use of *hay* instead of *hair*, in order to prevent the plaister from cracking. The hay should be cut to about three inches in length, but not shorter. The proportions of the ingredients are one measure of common rough sand, two measures of slacked lime, and three measures, but not less, of chopped hay. They are to be beaten up together in the manner of common mortar. It is recommended that the hay should be well dragged and intermingled with the composition; at the same time, it ought never to be put in till the other two ingredients are well beat up together with water. This rough sort of plaister ought never to be made thin; the "stiffer it is the better," says Lord S., "provided it be not too dry to be spread properly upon the laths."

As flooring-boards require, in many instances, to be laid soon, we may then adopt a different mode, no less simple and equally efficacious. His lordship states, that he had adopted it in a very extensive work with the greatest advantage. A fourth or fifth part of quick lime in powder is to be well mixed with the rough plaister, which will cause the composition to dry with great rapidity. His lordship recommends as the easiest method of reducing the quick lime to powder, to drop a small quantity of water on the lime-stone a short time before the powder is intended to be used, when the lime will by this process have acquired heat quite sufficient for the purpose.

When the rough plaister-work between the joists has become thoroughly dry, it ought to be re-examined carefully, in order to stop such cracks or flaws in the work as may have arisen from accident. If any should be discovered, it is recommended that a mortar-wash or light grout-

ing should be washed into such parts with a plaisterer's brush. The mortar-wash to be prepared as follows:—Provide about two measures of quick-lime and one measure of common sand; amalgamate these well with water; continue the process till the water grows thick, or to the consistence of a thin jelly: this, when used, will dry in a few minutes.

Previous to the flooring-boards being laid, a small quantity of very dry common sand should be strewed over the rough plaister-work, always excepting the *tops* of the joists. The sand should be struck smooth with a hollow rule, which ought to be about the length of the distance from joist to joist, and camber or curve in the centre about one-eighth of an inch. By applying this rule, we cause the sand to lay rather rounding in the middle of the interval between each pair of joists; the flooring-boards may then be laid in the usual manner, but particular attention must be paid to the rough plaister-work, sand, &c., being perfectly dry before the boards are laid; for fear of the *dry rot*, of which however, there is no kind of danger when this precaution is made use of.

Underflooring is also applied with the utmost success to wooden staircases. It is made to follow the shape of the steps, but no sand is laid upon the rough plaister-work in this case.

Extra Lathing is a term used when greater security is required for ceiling-joists or sloping (such as mansard or curb) roofs, and is simply this: when the laths are ready to be nailed on, some of the above-mentioned rough plaister should be spread between these laths and the joists (or other timbers), against which these laths are to be nailed close to each other. When either of the ends of any of the laths lap over other laths, it ought to be attended to, that these ends be bedded sound in some of the rough plaister. This attention is equally necessary for the second layer of laths hereafter mentioned. The first layer of laths should be covered with a thick coat of rough plaister; the second layer of laths are then to be nailed on, each lath as it is put on being well squeezed and bedded sound into the soft rough plaister. For this reason, no more of the first coat ought to be laid on at a time, than can be immediately followed with the second layer of laths. The second layer of laths ought to be laid as close to each other as possible, to allow of a proper clench for the rough plaister. The second layer may be then plaistered over with a coat of the same kind of rough plaister, or it may be plaistered over in the usual manner.

Treble Lathing may be used, but is seldom required.

Intersecuring is similar, in many respects, to underflooring, but no sand is required to be laid upon it. Intersecuring is applicable to the same parts of a building, as the method of extra lathing before described, but its application is only required occasionally.

C. DAVY, Architect.

3, Furnival's Inn, Oct. 10, 1835.

(To be continued.)

METROPOLITAN STREET-PAVING.

Sir,—The improvement of street-paving on inclinations having very justly attracted the attention of some of your correspondents, I beg to offer a few observations on the subject. Mr. Davy in his letter of the 5th ult., referring to the mode of pitching adopted on Fish-street Hill, says, "certain destruction awaits the knees of any animal that may fall upon its ridged surface," &c. This, doubtless, is true to a great extent; but as long as the new pavement is kept in a good working state, there is scarcely any fear of a fall, except in descending; and as I am persuaded the plan is a good one for ascending an inclination, I would suggest that, in altering the pavement of Holborn-hill, or of any other general thoroughfare, only one-half, that is the *near* side going up, should be pitched in the new manner. This appears to me to be necessary, for if the descending side were pitched like Fish-street Hill, stage-coaches, &c. could not use drags; neither could a coachman pull up his horses with any reasonable facility; because horses could not slide in stopping, as they do at present; and if a horse did come down, he would, as Mr. Davy observes, be ruined. The traffic on Fish-street Hill and Cow-lane has, I understand, very considerably increased since those hills have been pitched in the present manner; notwithstanding which, the number of accidents has greatly diminished. Formerly horses were down, particularly on Fish-street Hill, almost every hour; now a fall is quite a novelty. "T. C." in his letter of the 19th ult. speaks of the "new

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And am, Sir,
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C. B.

Soho-square, Oct. 5, 1835.

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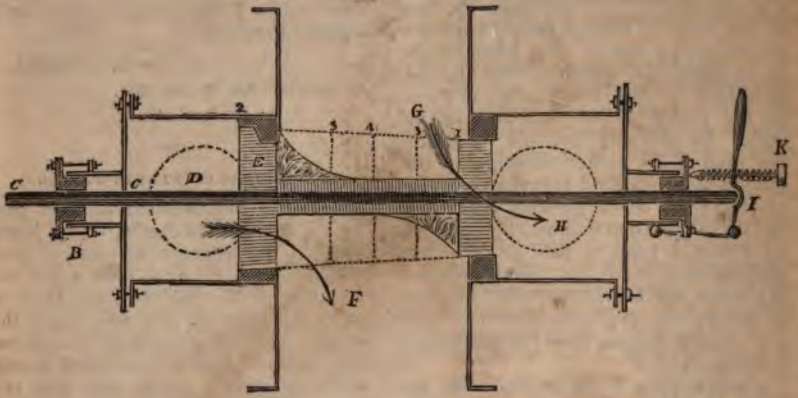
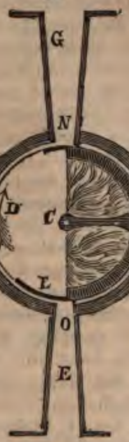
DESCRIPTION OF A TWO-WAY STEAM-COCK, WHICH ANSWERS ALL THE PURPOSES OF THE COMMON FOUR-WAY COCK.

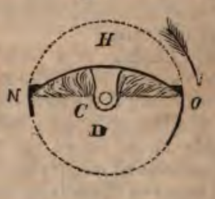
Fig. 1.



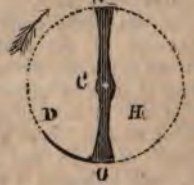
2



3



4



Sir,—Having been a subscriber to your useful and entertaining Magazine from its commencement to the present time—from which, I most conscientiously acknowledge having derived a great *deal of useful knowledge on mechanics, &c., and considering* that it is the duty of those who receive to give something in return, however humble the mite may be, I take this method of doing so by forwarding to you a description of a four-way cock, or, rather, a modification of a two-way one, answering the purpose of a four-way one. The model for casting I had made about thirteen years since, and the cock itself has been in actual use ever since 1825, during which time it has only required grinding about three times—a very decisive proof of its utility. It is, I believe, altogether new, and has been made solely from my own directions.

Description of the Figures.

Fig. 1 is a longitudinal section of the cock. A continued rotary motion is communicated by a bevil-wheel from the fly-wheel-shaft to the plug E, by means of the bar C, which works through the stuffing-boxes BB, and is firmly fixed into the plug E. The dotted circle D is intended to show the steam-pipe from the boiler, and the arrow the direction which the steam takes through the plug E and the pipe F, to the underside of the piston; G is the pipe leading from the upper side of the piston, from which the steam passes in the direction of the other arrow through E to the pipe leading to the condenser, denoted by the dotted circle H; I is a lever, with a handle against a cap or curved recess in which, the bar C works; and K a regulating screw; the use of which is to prevent the steam on one side of the plug and the vacuum on the other side from pressing it so tight into the hollow cone, as to wrest off the bar E, as also to allow of blowing through the engine previous to starting, by forcing the plug from its seat a little distance endways.

Fig. 2 is a cross section of the cock, C being where the bar passes through the plug at the line 2 in figure 1. It shows, likewise, how the steam passage is enlarged, by cutting out the solid brass round the bar C. The thin line commencing near to L is intended to show how much of the boiler side of the opening of the plug is cut away, it being in this allowed to act on the piston during three-fourths of its descent.

Fig. 3 is another cross section of the plug, showing it as cut through at 3 in fig. 1. The dotted line H shows the portion of the passage leading to the condenser.

Fig. 4 is another section of the plug through the line 4 in fig. 1.

The *modus operandi* will be easily understood, if we suppose the plug to move in the direction *of the arrows in figs* 2, 3, *and 4. When the crank is on its centre,* either up or down, the solid parts of the plug N and O will cover the passages G and F; as it moves forward, the part cut out at D allows the steam to enter the passage G until the solid part L closes the passage, after which the steam in the cylinder acts by expansion until the solid part N closes the passage F, which will be only for an instant, as the crank is passing the centre; the condensing passage of the plug being cut away as far as practicable, so that both the passages are entirely closed whilst on the centre.

I conceive, that if this sort of cock were adapted by the high-pressure engine-makers, it would be of great service, as it would allow the steam to be cut off at any point by cutting away the plug on the steam side one-third, one-half, three quarters, or any other proportion, according to the wish of the engineer, and thus allow of its expansion to its full extent. Besides, it will not be liable to get out of order, particularly if the adjusting screw K is properly attended to.

I am, Sir,
Your obedient servant,
W. Buckland.

Malmsbury.

ON WATER AS A PRIME MOVER.

Sir,—Mr. Galt has led the way, and has been followed by some of your correspondents, in what appears to me to be a most extraordinary delusion, viz. in considering a proposal to obtain power through the medium of Bramah's press—employing water as a substitute for steam. Now, I humbly submit, that instead of the case being *Water v. Steam*, it is, in fact, neither more nor less than *Steam v. Animal Power*.

"Kappa" has occupied several columns in one of your recent Numbers* with an elaborate account of the roundabout ingenuity which is often found to be exercised in fallacious pursuits. The total inapplicability of manual labour to locomotive purposes (through the intervention of machinery) has long since been clearly demonstrated, and almost every possible scheme for applying it has been resorted to in vain. The well-known and unalterable fact, that what is gained in power is always lost in time—might have shown "Kappa" the inefficiency of his proposed scheme for propelling carriers' waggons;

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* Page 514, vol. xxiii.

but, had he chosen to verify the truth of this law, and to have ascertained its application to his own particular case, he might have done so by a much easier and shorter road than the one he took. Instead of his 9-inch crank—De la Hire's double-acting pump, doubled—steam cylinder, &c. &c., all that would have been necessary was to have fixed a spur-wheel on the axle of the propelling wheels, and driven them by a pinion duly proportioned to the inverse quantities of time and power. The men's labour applied to the pinion by means of a winch-handle, would have produced all the effect to be derived from such a source, and more than could possibly be obtained by any more complicated train of mechanism.

An increase of power with an equivalent loss of time must have been the inevitable result, and the machine would have dragged its dull length along, at less than a funeral pace, much slower, indeed, than the common slow stage-waggons.

In good truth, the carrier's horses would have laughed their jealous rivals to scorn, giving them the go-by, and leaving them far behind to labour at their new and exalted vocation.

Among the numerous advantages which "Kappa" contemplated, was the fact, that "the stock of water would cost nothing."—"The expense of fuel, &c., would be avoided."

True, men do not eat either wood, coals, or coke; but it is not clearly shown, that "two or three men" would have been so proud of their new occupation as to have toiled night and day for nothing—and kept themselves! "Kappa" states, that when two men were working the lever, the engineer dryly remarked, "the principle throughout is good and correct, no doubt; it only wants a steam-engine to work the pump!" A keener piece of satire upon the whole affair could hardly have been uttered.

The principal error throughout this business consists in mistaking the *prime mover*, which is really the MEN; the *water* is only one of the means used for applying *their labour* in a particular form to the object required.

"Hydraulicus" (p. 460, vol. xxiii.) is not free from this error, but he takes a more correct view of the result; the fact *is, as he supposed (before* he was misled *by Mr. Galt's proposition)*, that no motive-power could possibly result from employing Bramah's hydrostatic-press; for the production of intense pressure, this machine stands unrivalled, and this quality constitutes its unfitness to be a conveyer or transmitter of motion; under all circumstances equilibrium must take place.

So far as the employment of De la Hire's pump for the purpose of raising water, or as a fire-engine, is concerned, I would beg to refer "Kappa" to p. 114, of your 20th volume, where he will find a convenient adaptation of it to these purposes by

Your obedient servant,
W. BADDELEY.

London, Sept. 29, 1835.

AUTOBIOGRAPHICAL PASSAGES IN THE LIFE OF MR. NASH.

Sir,—It has been to me, and no doubt to many others, no small matter of surprise, that the death of one who has for nearly half a century occupied so prominent a part in the history of metropolitan improvement as Mr. Nash, should have been passed over with no farther notice than a meagre paragraph in the *Athenæum*, which was copied into your 617th Number. Since that time I have daily expected to see the announcement of the publication of some memoir, of one who has altogether changed the face of a great part of the fashionable end of our metropolis. Although Mr. Nash's works are not built for posterity (and posterity will, no doubt, thank him for having so much consideration in sparing them the trouble of demolition), they are certainly the *chef d'œuvres* of what is capable of being effected with lath and plaster; indeed, so great a space of ground could not have been gone over in so short a time as has elapsed since the General Peace had it been otherwise.

Under these circumstances, I thought that it would be acceptable to the readers of the *Mechanics' Magazine* to transcribe some passages from his correspondence with the Board of Works on the matters connected with Buckingham House, which, as far as regards the defects of that structure as a State Palace, relieve him of the blame, and throw it upon Royal shoulders. It is a curious piece of autobiography, and a farther proof, if any were wanting, that amateur architects (although they even be Royal) generally produce monstrosities. If Michael Angelo had had a George the Fourth for a patron, Rome would not have been able to boast of St. Peter's.

"His late Majesty's intentions and commands were to convert Buckingham House into a private residence for himself. A plan was made upon a small scale, merely adding a few rooms to the old house. Whilst this plan was forming, and on my observing that the plan was being enlarged, I continually urged his Majesty to build in some other situation, and made several plans for that purpose, using all the arguments in my power to dissuade his Majesty from adding to the old Palace, but without any effect; for the late King constantly persisted that he would not build a new Palace, but would add to the present house. I then urged his Majesty to pull down the house, and rebuild it higher up in the garden in a line with Pall-Mall. To induce his Majesty's acquiescence, I stated the lowness of the present site and the northern aspect, and recommended that the house should be placed on a level with Hyde Park Corner, and in a line with Pall-Mall, a road or prolongation of which should cross the Green Park as an approach. This proposition I thought had some weight, and for a time I had hopes my recommendation would be adopted; but one day, either at Buckingham House or Kensington, his Majesty took me to Lord Farnborough, and said, good-humouredly, 'Long, now remember I tell Nash before you at his peril, ever to advise me to build a palace. I am too old to build a palace. If the public wish to have a palace, I have no objection to build one, but I must have a *pied à terre*. I do not like Carlton House standing in a street; and, moreover, I tell him I will have it at Buckingham House; and if he pulls it down he shall rebuild it in the same place; there are early associations which endear me to the spot.' Such were nearly the words that passed. From that moment I never presumed to press his Majesty on the subject of building a palace, or of removing the site. Plans were accordingly made, and, with a rough estimate, submitted to Lord Liverpool. Before they were decided upon, very considerable additions were commanded, and further estimates, until at length the plans, nearly as they now are, were completed and approved, and I was directed to carry them into execution. The building being so enlarged, and additions being daily suggested, I began to think the King might be induced to make use of it as a State Palace, *and I frequently expressed my fears to his Majesty; but he persisted in saying, that he should continue* to hold his Courts at St. James's, and that he never would hold them at Buckingham House. After the building was covered in, his Majesty sent for me to Carlton House, and said, 'Nash, the State rooms you have made me are so handsome, that I think I shall hold my Courts there.' I took the liberty to submit to his Majesty how unfair such a determination was to me as an architect; that the building was not arranged in a manner suitable to a State Palace; that no provision was made for the establishment of a Queen, nor for the office of the Lord Chamberlain or the Lord Steward. To these he replied, 'You know nothing about the matter; it will make an excellent palace, and Lord St. Helen's and myself have arranged the use of the several apartments.' This arrangement his Majesty then explained, and I pointed out the objections as they occurred to me, all of which he overruled, saying, 'Lord St. Helen's and I have arranged all that.' This explanation, which can be confirmed by Lord Farnborough, Lord St. Helen's, and Sir William Knighton, may, I trust, protect my plans from the observations which must otherwise result from the Lord Chamberlain's and Lord Steward's reports. His Majesty never contemplated the Lord Steward's or Lord Chamberlain's establishments at Buckingham Palace; and when I mentioned the necessity of taking down St. James's Palace, in order to carry the Parliamentary plan of improvement in St. James's Park into effect, I stated the necessity of providing for the Lord Chamberlain's and Lord Steward's offices. I trust this statement will be a sufficient justification against any remarks that may be made to my prejudice respecting the fitness of the plan for a State Palace. The paucity of light that has been complained of in part of the basement story, was occasioned by his late Majesty not wishing to have any of the windows of the servants' room overlooking the Terrace; and covered areas were substituted for the gardens proposed by me on a level with the basement; but the ground may be easily removed and these lights restored.

"The appropriation of the apartments in the basement story was settled with the different officers who were to occupy them; any observations, therefore, that are applicable to this part of the plan, are answered by the circumstance, that they were suggested, made, and approved by the late King, for whose use the Palace was planned, and neither I nor any one else can be blamed, if they do not suit the present establishment.

"To the objections to the light of the gallery, I beg to answer that the late Sir Thomas Lawrence was consulted by me, and expressed his approbation; that other galleries for works of art which have been frequently praised on account of the distribubution of light, are lighted in the same manner; the only objection that can be urged against it is, that the light being so close to the walls, the projection of very deep frames may cast a shadow on the upper part of the pictures; but a row of circular lights is made in the centre of the ceiling, although at present closed, which, if opened, would disperse the shadow cast by the frames, and then, I trust, the alleged defect will be remedied."

In defending his work from the charge of insecurity which had been brought against it, and in proof of which he said the Committee only brought forward opinions, not facts, he refers to works which he had effected "of great practical difficulty, both in construction and execution."

"In enumerating a few of those works of difficult construction and execution which I have accomplished, I shall do little more than name them, as I regret the necessity of appealing to them at all. One of the first works of this kind was the restoration of St. David's Cathedral; the west front wall, 70 feet high and 10 feet thick, had for half a century overhung its base, and which had been continually increasing, and was plumbed every year, and its progress towards falling marked down. At the time I was called upon by the Chapter to examine it, the top overhung the base 4½ feet; the Saxon arches on each side of the centre aisle, all the way to the choir, leaned against this wall, and which was their only support, inasmuch that, had it fallen, the whole of the church as far as the choir must have fallen with it. I constructed a timber buttress on a temporary foundation, and supported the whole of the Saxon arches; I then took down the wall from top to bottom, prepared a new foundation, and rebuilt the wall upright, encased the temporary buttress with stone, and substituted stone arches for the wooden buttress. During which operation not the slightest accident happened; and though this work has been done 45 years, not the slightest settlement has taken place, and it is a perfect work at this day.

"When Sunderland Bridge was to be built, I was employed to make designs and estimates for a stone arch of 300 feet diameter; the practicability of which was denied by those who objected to any bridge being built at all, and a violent party contest took place between those who projected and those who opposed the bridge, and a Committee of the House of Commons of that day were selected to decide the question of bridge or no bridge. The party opposing denied the practicability of executing a stone arch of that size; and to support their opinions, Dr. Hutton, Mathematical Professor at Woolwich, Mr. Smeaton, who built the Edystone Lighthouse, and Mr. Mylne, who built Blackfriars Bridge, were called in, and examined before the Committee.

"They rested the impracticability of the measure on the circumstance that so vast a structure in stone required a very different process in every part from that required for bridges of the largest size that ever had been built. To combat the opinions that I knew would be given by those three eminent men, I had recourse to the making a model of a very large size, together with the machinery and contrivances necessary to meet every difficulty which should be proposed, and establish the practicability of the arch.

"The model was produced before the Committee. Mr. Mylne insisted on his experience to state at once, without examination of the model, that it was impracticable. Mr. Smeaton declared, that he never denied the practicability, but that, on the contrary, he could build a bridge from Dover to Calais; that no doubt the model I produced could be executed, but that no one could calculate the expense. Dr. Hutton admitted the practicability, but recommended a catenarian arch in preference to a circular one. The result was, that the model was approved in all its parts, and the Bill passed.

"On account of the stone arch, the present iron one was adopted, formed from the model at that time exhibiting by Tom Paine; but such was the effect of the investigation, that I had frequent invitations to form piers, docks, and other works, exclusively the province of engineers.

"The late Mr. Rennie pressed me to give a design for building London Bridge, offering me the use of his survey and section of the river.

"When the tunnel under Highgate-hill, designed by the late Mr. John Rennie, fell in, I was called upon to ascertain the cause, and suggest the remedy. I removed the whole of the tunnel, supported the ground for the depth of 80 feet, and built the present archway. The difficulties which were encountered in these operations would hardly, if detailed, be credited.

"The late Mr. Rennie, in his pamphlet addressed to the Commissioners of Sewers on the subject of substituting a new common sewer to drain the west end of the town (the old one being decayed and inadequate), suggested a tunnelled sewer, but doubted its practicability without taking down a great number of houses.

"That sewer I effected, and made the tunnelled sewer, without taking down or injuring a single house. In a Committee of the House of Commons, engineers were brought to oppose the making of this sewer, principally on the impracticability of ascertaining the expense; my estimate was 50,000*l.*, or thereabouts; when it was said that it would cost more than 100,000*l.*; the actual cost, however, was within 1,500*l.* of my estimate, over or under, I do not recollect.

"Knowing the danger attending cast-iron bridges as they are usually constructed, I invented and obtained a patent for bridges of iron, to which no objection ever was or can be made; it has all the weight and semblance of a stone bridge, but is infinitely stronger than any stone bridge can be made, for it has no lateral pressure; on this invention I have built an arch of 100 feet span, rising only six feet, being a portion or segment of a circle 460 feet diameter."

There are not many who could refer to a work of *forty-five* years' standing for a testimonial of ability; but Mr. Nash seems to have been a better engineer than an architect. I do not think it is generally known that he built Highgate Archway—it is more commonly attributed to Mr. Rennie.

I am, Sir, your obedient servant,
W. A. R.

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ILLUSTRATIONS OF THE PHENOMENA OF HALLEY'S COMET.

(Continued from vol. xxiii., p. 523.)

[*Note.*—The reader will please to consider this as connected immediately with the paragraph in p. 523, ending with "X. Y. Z." The remainder of that page was intended as a distinct communication, but was united with the other by the printer. In line 31 of that page, for ☋S☊, read CSC.]

I would first observe, that the projection having been made exactly according to the elements of the *Nautical Almanac*, it will now be advisable to make an alteration in the dates assigned to the comet's several positions. The phenomena will be more truly represented, if the position denoted by

10	be understood to indicate the comet's place on ..	Aug.	20
19	———————	——	29
29	———————	Sept.	8
8	———————	——	18
18	———————	——	28
28	———————	Oct.	8
8	———————	——	18
18	———————	——	28
28	———————	Nov.	7
7	———————	——	17
17	———————	——	27
27	———————	Dec.	7
6	———————	——	16

If a line be drawn through any two corresponding places of the earth and comet, in fig. 1, and continued till it intersect S A, the angle formed by those lines (reckoned from A in the direction of the signs,) will be the comet's geocentric longitude. In fig. 2, let fall a perpendicular upon the ecliptic from the corresponding place of the comet, and from the intersecting point set off on the ecliptic, a distance equal to that between the earth and comet in fig. 1. Joining the point last found, and the vertex of the perpendicular, we have a right-angled triangle, the angle at whose base is the comet's geocentric latitude, and the hypothenuse is the true distance of the two bodies. A carefully drawn projection will, by these means, and with little labour, furnish a series of geocentric places sufficiently accurate for delineating the apparent path on a globe or map, corresponding to the elements originally assumed.

An examination of the diagrams will explain why the comet's motion, though really retrograde, is apparently direct throughout the upper part of its orbit, namely, that its path lies, as it were, between us and the sun, the elongation never amounting to 90°. Also, the cause of the rapid increase of apparent motion towards the middle of October, and the great northern latitude compared with the heliocentric elevation.

By the same method it will be seen how it happens that a variation of a few days in the epoch of perihelion has such a considerable effect upon the apparent path, especially as to the maximum of geocentric latitude.

The right ascensions and declinations of the comet may also be deduced from the same projections, although not so readily, because the plane of the equator is perpetually shifting, preserving, however, its parallelism. The method of obtaining the heliocentric co-ordinates, x, y, z, has already been shown. By combining these with the earth's co-ordinates of correspondent dates, that is to say, taking their sums when the plane lies between the two bodies, and the differences when they are both on the same side of it, a triple set of co-ordinates may be obtained, which apply to the relative orbit of the comet about the supposed stationary earth. With these compounded co-ordinates, a pair of new diagrams may be formed, having the earth instead of the sun for their centres. The relative path of the comet will appear in one of these diagrams, as projected on the plane of the equator, and in the other as referred to the plane of the solstitial colure. The right ascensions, declinations, and distances of the comet are deducible from these diagrams, in the same manner as the longitudes and latitudes are to be obtained from the original ones. Perhaps what has been stated respecting the right ascensions and declinations may not be quite clear to some, without the actual exhibition of these auxiliary diagrams. The construction of these, however, is left as an exercise to those who wish to obtain a complete idea of the subject; and the coincidence of the geocentric longitudes and latitudes derived from the first projections, with the right ascensions and declinations obtained by the others, will constitute a proper test of the accuracy of their operations.

J. W. WOOLLGAR.

Lewes, Oct. 7th, 1835.

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SIMPLE MARINER'S LOG.

Sir,—I beg to solicit the favour of a small corner in your valuable Journal for a few remarks on the mariner's log. It has occurred to me, that a simple and efficacious log might be made in the following manner:—Take a line of the same size as an ordinary log-line, and to one end attach a piece of wood, of the form and size determined by experiment; the wood to float upon the surface of the water, and to be towed by the vessel; the other end to pass, by means of a small hole in the stern of the vessel, into the cabin, and to be attached to a species of clock-work, with a 'scapement similar to a chronometer, and having a dial and three pointers or indices, to point out the units, tens, and hundreds of miles. It is evident, that the faster the vessel sailed the greater would be the pull on the line, and, consequently, the apparatus must move the quicker, and I think point out correctly the progress of the vessel over the waters. Persons not wishing to go to the expense of the clock-work might attach the line to a spiral spring, similar to Salter's spring-balance, which would require the noting *down, from time to time,* the speed of the vessel as indicated by the spring.

I am, Sir, your obedient servant,

G. S. HOLLAND.

Limehouse, Sept. 21, 1835.

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REMARKS ON THE CONSTRUCTION OF BOG ROADS. BY WM. BALD, ESQ. C. E.

(From the Third Report of the Commissioners of Public Works of Ireland.)

Below Lough-a-veun there is a soft, deep, and extremely wet bog, and over it the Antrim coast road passes.

With regard to the making of roads over bogs, it may perhaps be necessary to offer a few observations, as roads require to be made frequently over them in many parts of Ireland, bogs occupying nearly one-fifth of her surface.

In making roads over soft, wet bogs, the first operation has been to make double drains on both sides of them, and then to tap off, by small drains into the main ones, all the small pools of water which may be on the surface of the bog between the drains, and also adjacent to them; thus, in the first instance, freeing the whole face of the bog which is destined for the floor of the road from stagnant surface-water.

The drains in deep, soft bogs, can only be sunk to a proper depth by continuous operations during successive seasons; and this will be best done in the summer months, when the weather would be dry, and deepening them gradually.

After the bog has been well drained, the whole surface of the road should be brought to a fair level, by filling up and covering all surface irregularities with firm heathy sods, taken from a dry heathy bog surface, cut evenly and parallel on the sides, and square at the ends. In all fillings, the heathy sides of the first course of bog sods should be placed downwards; and when the whole surface for the road has been brought to an even level, regular courses of heathy sods should be laid on over the whole breadth, from fence to fence, fair and regular, closely set together, and breaking joints with the under course of sods. In all trunking or embanking over bogs with heathy sods, the top surface should always finish with the heathy sides upwards, and with a convexity. In many cases it will be necessary to lay three courses of bog sods, even after the surface of the bog has been made level; and in some cases even four and five will be required to make a solid and firm vegetable embankment fit to carry the road materials. And to effect this part of the work in a perfect and substantial manner, will give great durability to the road; but if imperfectly executed, it will be an utter waste of materials and labour to attempt to make any thing like a good or a permanent road; because the road will sink below the level of the bog's surface, get out of shape, and be subject, in many instances, to be covered with water during the rainy periods of the year.

The road should be first finished as to level and shape before any fences be made.

Over the embankment or trunking will be spread a coating, of four inches deep, of mixed earthy and gravelly matter, which will be set into a firm mass, over which, when properly consolidated, will be laid the broken stone or prepared clean gravel, as in ordinary cases.

THE LETTERS PATENT LAW AMENDMENT ACT.

The *Times* having done us the honour to quote a portion of our observations on this Act, Mr. Archibald Rosser has addressed a letter to that Journal by way of reply to them; and has, by this roundabout plan of proceeding, gained a day or two's currency for certain misrepresentations and misreasonings, which, had his letter been at once addressed to us, we could and should have instantly exposed. Stealing a march this is undoubtedly,—*and something more.*

Mr. Rosser opens upon us in these terms:—

> "I have to say that the Editor of the *Mechanics' Magazine* is misinformed in stating that the Act does not work well in respect of the amendment of specifications. At the time that gentleman *wrote* a specification had been amended under the Act, the Attorney-General and Solicitor-General concurring in the *modus operandi*."

Passing over the quibbling which lurks under the word "*wrote,*" we beg to reassert not only the perfect accuracy of our information, but to deny utterly the truth of the statement with which Mr. Rosser clenches his *contradiction.* We think we are fully entitled to do so, from the circumstances which we shall now briefly relate. A day or two after the passing of the Act we called at the Attorney-General's office for the purpose of inquiring in what manner it was expected parties should proceed, who desired to enter a memorandum of alteration, when, as we have before stated, we were informed the statute left the form of proceeding in so much doubt, and in any view so open to serious exceptions, that it could not be acted upon until a case was laid before the Law officers of the Crown for their consideration and opinion. We were accompanied on the occasion by an eminent solicitor and by another gentleman (a friend of the patentee, in whose behalf we applied), to whom we have shown this statement of what passed, and who are ready to attest its correctness. No such corroboration, however, is necessary, as the respectable gentleman (Mr. Cooper), who transacts the business of the Attorney-General's office, does not himself gainsay it. We saw this gentleman again on the subject, on the 29th of September, when he told us that the matter still remained in *statu quo.* And on Thursday last, after the appearance of Mr. Rosser's letter in the *Times,* we extracted from it that part which we have quoted above, and sent it to Mr. Cooper with a request for an explanation. A person soon after called at our office from Mr. Cooper, and made a communication to the effect, contained in the following memorandum:—"Mr. Cooper says, that applications have been made for the amendment of specifications and caveats also entered, but *no further steps taken;* and that *nothing will be done* until Mr. Dealtry, the Clerk of the Patents, returns to town, and the Attorney-General and Solicitor-General can arrange with him some form of practice under the present Act." Here, then, is proof positive, that up to the present moment the Act does *not* "work well," and proof, almost as positive, that Mr. Rosser must be greatly *mistaken* (to use no harsher term) in asserting, that a specification had, at the time we "wrote" our last article on the subject, been actually "amended under the Act"—"the Attorney-General and the Solicitor-General concurring in the *modus operandi!*" We feel warranted in believing that there is not one syllable of truth in the statement, and think we may, with great safety, challenge Mr. Rosser to favour us with the name and title of the specification, that he asserts to have been "amended." A sketch of the "*modus operandi*" concurred in by the Attorney-General and Solicitor-General, may also be considered as, under all the circumstances, a great *desideratum* .

"The Editor of the *Mechanics' Magazine*," proceeds Mr Rosser, "has a tale to tell of the private history of this Bill;" but "does any body," he asks, "imagine that a Bill, especially amidst excitement such as that which attended the last Session, would unaided carry itself through Parliament?" Not "unaided," certainly; but there are two ways, as we need hardly inform this special-pleading gentleman, of aiding a measure—fair and foul. He knows well that we did not allude to any thing of the former description, and if he will but pluck up courage enough to challenge us to state frankly to what we did refer, we shall not be slow in answering it.

Mr. Rosser denies further, that Lord Brougham has been made a "tool of in the affair," and affirms that, "in truth, the Act is Lord Brougham's." So much the worse, say we, for Lord Brougham, if this be the "truth;" for whether it be looked at in a legal, in a philosophical, or in a literary point of view, it is altogether a very pitiful production. But is the "truth" really so? Has Mr. Rosser always borne the same testimony to the truth? And has he never given a different version of the truth? Assumed to *himself*, for instance, the credit of the Bill—called it "my Bill"—and boasted of carrying "my Bill" through a host of difficulties and against a world of opposition? Will he dare us to the proof?

We meant to have touched on some of the misreasonings which are dovetailed into the misrepresentations in Mr. Rosser's letter, but see that we have no room left. They are of so very shallow a sort, however, that we do not imagine they can deceive any person who will bestow a moment's thought *upon them.*

NOTES AND NOTICES.

Taste in Humble Life.—A writer in the last Number of the *Monthly Repository* mentions the following facts, in illustration of the proposition, that "taste is no stranger to the English village:"—"At Carshalton, in Surrey, Mr. Lorraine has supplied with musical instruments the talent of the town, and a very efficient band of his neighbours perform weekly in his concert-room. The Norwich weavers are renowned for their style of singing Handel's choruses." It might have been added of our Norwich friends, that they have been long renowned also for their love of flowers. The late Sir James Edward Smith, the Founder of the Linnæan Society, has somewhere spoken of their botanical pursuits in terms of the warmest praise. The manufactures and botany of Norwich are supposed to have been imported together from Flanders.

Antiquity of Lead Mines.—In proof of the lead mines of Derbyshire having been wrought by the Romans, we have the authority of Dr. Millar, who states, "that in the year 1777 a pig of lead was found on Cromford Moor, and the interpretation of the inscription is 'The sixth legion inscribes this in memory of the Emperor Adrian.'" Several others have also been found at different periods; one about the year 1790, weighing 12 stone, was found at Matlock, bearing the following inscription:—"Tr. Cl. Tr. Lut. Br. Exarg.," which are supposed to be the abbreviations of "Tiberii Claudiani Triumviri Lutudari Britannorum Exargentaria." In the British Museum are several pigs of lead of great antiquity, one of which has also the mark of denoting it to have been made in the reign of the same Emperor.—*Mining Review.*

We recommend to R. S. a careful perusal of Mr. Baddeley's paper in our present Number on the application of the Hydraulic Press to the production of rapid motion. Should he think the practicability of his scheme not affected by it, we shall be glad to hear from him again *with his reasons.*

Tyro's plan for employing compressed gas for ærostation, is not the first by a dozen of the same kind.

Communications received from Lieutenant Wall—⊕—Mr. Mackenzie—Mr. Horsman—F. G. W.—R. S.

Erratum.—Vol: xxiii., article on Furrow Tile Draining: p. 383, col. 1, l. 7, for "headings," read "leadings."

Mr. Barlow requests us to state, that he is about replying to the charges made in Mr. Beale's letter inserted in our last Number. He is waiting for some documents from the country, or would have answered it this week.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price *6d.* Also, the volume complete, in boards, price *9s. 6d.*

☞ Patents taken out with economy and despatch; Specifications prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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HUNTER'S STONE-PLANING MACHINE.

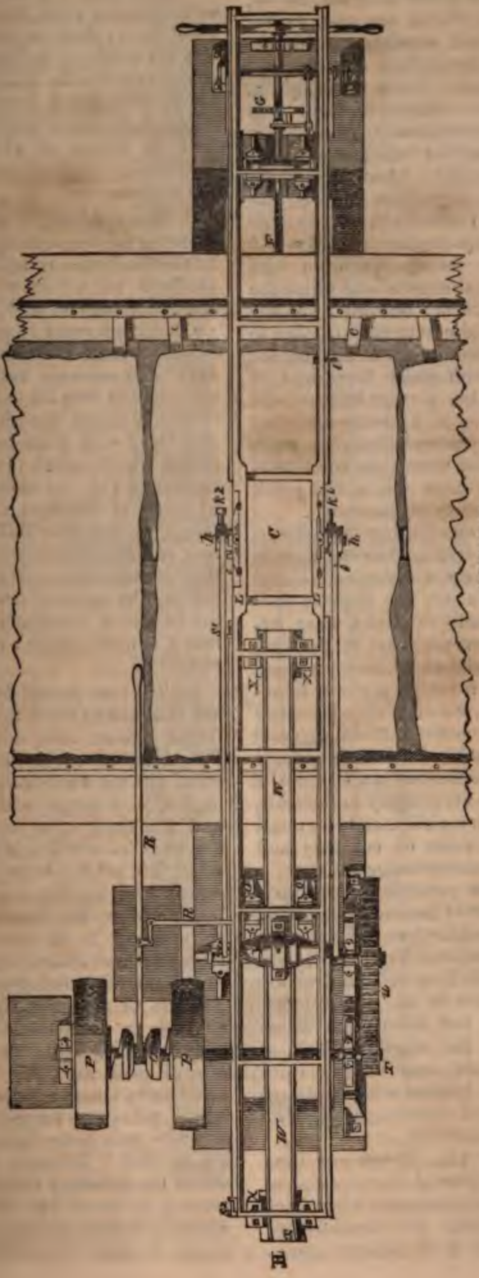


Fig. 1.

HUNTER'S STONE-PLANING MACHINE.

Among the few exceptions to the universality of steam-power as a first mover, which existed a year or two ago, by far the most important was its very limited applicability to the cutting, dressing, and fashioning of stone. Many attempts had been made—some of them by machinists of first-rate eminence—to construct a steam-power machine which should supersede the mason's hand-mallet and chisel; but one and all had proved entirely abortive. Difficulty there was none in contriving steam-machinery that would slice or hew in pieces, and even with great nicety, the stoutest blocks which the quarry could furnish; but the difficulty lay in this, that the immense friction to which metal points or edges are subject, when brought with great force and in rapid succession into contact with so hard and gritty a material as stone of every description, caused so prodigious a waste in tools, that it far more than counterbalanced any advantage that could result from superior celerity of execution.

The merit of overcoming this serious objection, and of adding thus one more to the triumphs of the steam-engine, belongs to Mr. James Hunter, the Superintendent of the Leysmill Quarries, near Arbroath. After several years of thinking and contriving, and experiments without number, he has invented a power stone-planing machine, which is so ingeniously and judiciously contrived, that it cuts and dresses the largest blocks of stone not only with as much exactness as can be done by hand, but with so little injury to the tools, and with so much rapidity, as to leave all hand-labour, in point of economy and dispatch, at an immeasurable distance.

We have before presented our readers with some samples of the wonderful capabilities of this machine (see the Report of Messrs. Carmichael and Kerr, C.E., published in our 612th Number), and we are glad to have it now in our power to lay before them the first description which has appeared of the machine itself, to which we shall add some additional information of great interest which we have been favoured with by the patentee respecting its performances.

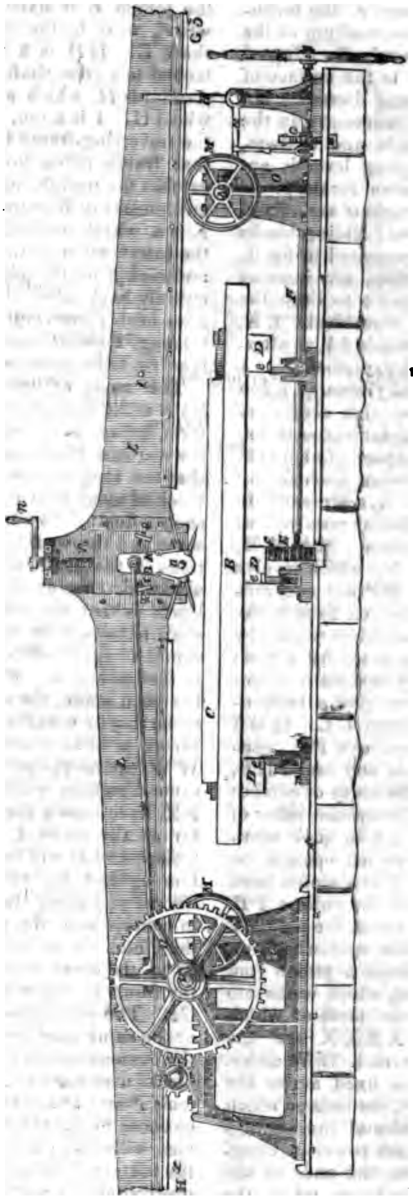
The engraving (fig. 1) on our front page represents a plan of the machine as it appears in its complete state when fixed and ready for working, to a stone bed or foundation; and fig. 2 is an end elevation thereof. The steam-engine employed is omitted in both views.

The machine, of which A A is the sole or foundation plate, consists of three principal parts; *first*, a platform, which carries the stones to be planed; *second*, two tilt or cant blocks, which hold the planing tools; and, *third*, a traversing-frame, in which these tilt or cant blocks are fixed, and by means of which the tools are brought into action against the surface of the stones.

1. The *platform for the stones*. On the sole or foundation plate A A, three rows of traverse-rollers *a a a* are fixed. B B is the platform on which the stones C C are laid; it moves to and fro on the rollers *a a*, and is formed of planks, four inches thick, laid across three longitudinal beams D D, and securely bolted thereto. The two parallel bars *b b* nailed to the surface of this platform are about an inch thick, and faced with plate-iron; they serve as ledges within which to secure and steady the stones C C, by means of loose chocks of wood of different sizes. Where the longitudinal beams D D D of the platform rest or bear on the traverse-rollers *a a a*, they are strengthened to meet the extra pressure by under-plates of iron *e e e*. To the bottom of the central beam a toothed rack *f* is fixed, which extends from end to end.

2. *The cant or tool blocks*. B K, B K, are two blocks fixed into the traversing-frame, one on each side, with two tools $i^1 i^2$, $k^1 k^2$, in each. Fig. 3 is a front-view, and fig. 4 a side-view, of these cant-blocks, on a larger scale than in figs. 1 and 2. They turn on studs *h h*, which are fixed in vertical sliding-blocks *m m*, which are moveable up and down by the screws and handles *n n*, so as to be adjustible to any thickness of stone that may be required to be cut. The two tools marked i^1 and k^1 are roughing tools, and those marked i^2 and k^2 are finishing tools. All are of a round form, and about an inch in diameter; the two finishing ones have chisel or broad mouths. Both sets of tools are fixed in wrought-iron tubes *o o* by means of adjusting screws *p p*, which tubes are turned so as to fit accurately into holes bored in the cant-blocks B K. To each set of tubes in which the finishing tools are fixed a short lever *q* is keyed on, the upper end of which is slightly curved and toothed, and above it there is a horizontal screw *r*,

Fig. 2.



ELEVATION.

which works into the teeth of this lever q, so that by applying a spanner to the square head s of the screw r, the finishing tool may, through the medium of the screw, the lever, and the tube, be adapted with the greatest nicety to the surface of the stone to be planed and dressed. No such nice adaptation is necessary in the case of the roughing tools, and to them, therefore, no such adapting lever is applied. G, fig. 3, is the cover for the pivots of the screw r. Two brackets are affixed to the face of the vertical sliding-blocks $m\,m$, in the manner represented in fig. 1, and two screws, t and u, are inserted therein, which screws serve to limit the arc described by the cant-blocks B K, B K, in turning on the studs $h\,h$, as afterwards more particularly explained.

3. The *traversing-tool frame.* L L is a large sliding-frame, in the centre of which the working or planing tools are fixed, and which has a space of about six feet to traverse in, three on each side of the position in which it is represented in the engravings. This frame rests on four wheels or friction-rollers M M M M, affixed to the shafts N N, which revolve in brackets O O O O. P P are two pulleys, which revolve on an axis fixed in the standards G G, one of which is worked by an open strap, and the other by a cross strap, so that they may revolve in opposite directions, and thus give a reciprocating motion to the frame L L. Q is a clutch between the pulleys P P, connected with the handle and crank R R, which are acted upon by studs or catches S^1 and S^2, projecting from the sides of the sliding tool-frame L L in such manner as to make the clutch operate on each tool alternately. T is a pinion fixed to the end of the axis of the pulleys P P. U, a spur-wheel, into which the pinion T works, V the axis of this spur-wheel, on which axis there is fixed a pinion (not seen in the engravings), which works into a sliding-rack W W, the teeth of which point downwards. X X X X are the bearings on which the rack W W slides. Y Y is a strong beam fixed across the back of the rack W W, the ends of which project through the sides of the sliding-tool frame L L. Z Z are two connecting-rods, which pass from the ends of the beam Y Y to the blocks in which the planing-tools are fixed, as before explained. E is a pinion, which works in the toothed rack f on the under side of the central longitudinal beam of the platform B. F is a shaft, to one end of which the pinion E is fixed. G is a ratchet-wheel, near to the opposite end of the shaft E. H H is a pall and crank attached to a cross shaft, supported by the standards $l\,l$, which acts on the ratchet-wheel G. I is a pin, fixed in the side of the traversing-frame L L, and which, as that frame moves towards the side Gz, catches the upright arm of the crank H, and presses it forward in that direction. K is a wheel, which, operating through the intervention of the shaft F, pinion E, and rack f on the platform B, throws it entirely back when all the stones upon it have been planed, or returns it under the planing tools if any part of the work requires to be gone twice over.

The *mode of operation* requires but little additional explanation. The platform being filled with blocks of stone, the vertical blocks $m\,m$ are so adjusted that the roughing tools shall strike each block of stone as it passes under them, at such a depth below the top surface, as to sever and throw off before them large portions of the stone at a time, taking care always that the depth shall be within such limits as that the line of least resistance shall terminate in the top surface of the stone, so that the fractures shall all tend in that direction. When this adjustment has been made, the sliding-frame L L is to be moved towards Hx, and as it traverses in that direction the sliding-rack W W carries the cross beam Y Y in the same direction, until the connecting-rods Z Z have drawn the cant-blocks over as far as the screw t, when the roughing tools i^1 and k^1 will be brought into operation against the stone, and so continue till the projecting stud or catch S^1 comes in contact with the crank R, and throws the clutch off the pulley then in operation on to the other pulley, which will make the frame return in the opposite direction Gz. The sliding-rack W W carries back at the same time the cross beam Y Y, till the connecting-rods Z Z push the cant-blocks over against the screw u, when the tools i^1 and k^2 are brought into play, and so continue till the catch S^2 comes in contact with the crank, and again reverses the motion. At the moment of this last reversal of the motion taking place, the projecting pin I also throws over the upright arm of the pall and crank H H (in a manner similar to the yard-beam of a

Fig. 4.

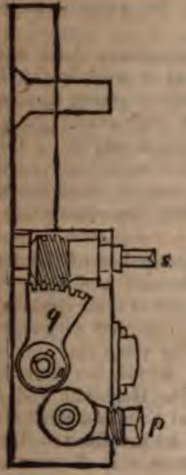
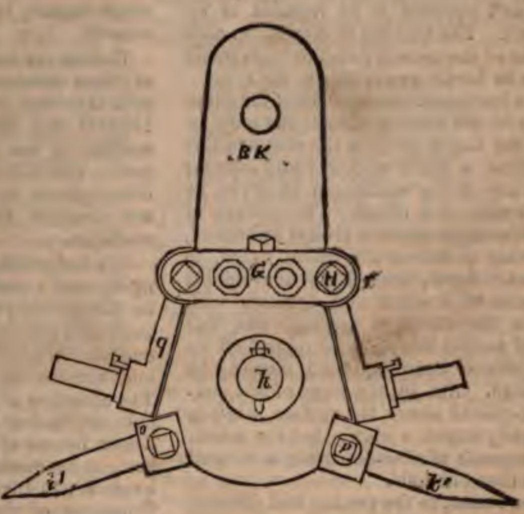


Fig. 3.



power-loom), and brings forward the platform B with the stones for the next operation of the planing tools. The pall and crank H H falls back of its own weight into its former position, as soon as the pin I recedes from it. When the roughing tools are first brought into action, through the traversing of the frame L L towards H *x*, they commonly leave the surface of the stones in ridges, but the finishing tools being farther back, take off these ridges when returning, and so on till the planing of the blocks is completed.

No time is lost in clearing the platform of the finished blocks, as the men in attendance on the machine are removing the blocks at one end while the machine is at work at the other, and a minute or two suffices to return the platform. The frame L L generally traverses at the rate of 30 feet per minute, and a set of stones filling the platform from end to end, can be planed in about 45 minutes. As each tool wears it can be readily removed for the purpose of being repaired, or replaced by new tools by loosening the adjusting-screws *pp*.

The master feature of the invention appears to us to consist in the means provided for so adjusting the roughing tools (which have the roughest part of the work to perform), that they shall strike the blocks of stone as they pass under them, not *upon* the surface, as usual, but at *such a depth below it*, that the surface is driven off in large portions at a time. Not only are two or three tools thus able to do the work of a great many,* but the tools have time given them between each stroke to cool; or, to speak more properly, the strokes are made at such intervals that the tools never get sufficiently heated and softened to lose their original tempering. And hence this somewhat paradoxical consequence, that *the greater the thickness of surface which the tools have to cut away, the greater will be their efficiency and the less they will be injured;* for the lengths of stone driven off at each stroke will always be proportional to the depth of the cutting, and the rest given to the tools in exactly the same ratio. We are informed that, in point of fact, the wear of iron is less by one-half in taking off two inches at a time than in taking off half an inch.

Another valuable though subordinate feature of the apparatus, is the ingenious manner of securing the tools in their places—the union of absolute fixedness while in operation, with the greatest facility for removing them as they are worn out and required to be repaired or replaced. The shaking or recoil after each stroke of the tools is stated to be so small, as to be hardly perceptible to the eye.

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* In a stone-planing machine lately patented, the capabilities of which were much talked of for a time, there were no less than from 30 to 40 tools, to be applied in rapid succession to the stone.

An important consequence of the equability of the force applied to the tools is, that the facing given to the stones by this machine is much smoother and sounder than any facing which can be given by the mallet and chisel. The surface of hand-wrought stones is always so bruised, or, what is technically called *dazed*, to a certain depth, through the unavoidable varieties of strength and direction with which the chisel is applied, and this dazed portion has all to be rubbed off by the polisher before a sound face can be obtained. But in the case of the machine-planed stones, the surface is left in so nearly sound a state, that the labour and expense of after-polishing is reduced more than one-half.

The stones, to the cutting and dressing of which this machine is advantageously applicable, must not, of course, be any of an exceedingly precious description—none of the rarer marbles for examples; but such as exist in so great abundance, that an inch more or less cut away from a surface is of no consequence, and such too as acquire their chief value from the labour bestowed on extracting them from the quarry, and dressing them for use. The sorts of stone to which the patentee considers it to be most applicable, are sandstones, limestones, and freestones in all their varieties.* The power and velocity requisite vary considerably, according as the stone is soft or hard. Thus, for example, the Arbroath, which is a sandstone of very close and firm grain, admits of a degree of speed many times greater than some of the softer sandstones; and requires a power just so many times less. Again, stone harder than the Arbroath would require both the strength of the machine and the power of the steam-engine to be proportionally increased.

During the last summer there were six of these machines at work in the Leysmill Quarries, which planed upwards of 170,000 feet of pavement. They are worked by one steam-engine of 6-horse power, which has to work besides two inclined planes, up one of which the stones are dragged from the quarry to the machines.

We have before spoken of the Report of Messrs. Carmichael and Kerr, C. E., on the performances of these engines, and must here content ourselves with referring our readers to it for some very important and satisfactory details on this head. The attention of the Highland and Agricultural Society of Scotland having been drawn by one of its members to this Report, their Secretary was directed to request W. F. Lindsay Carnegie, Esq., the Proprietor of the Leysmill Quarries, to favour them with "a statement showing the comparative expense of machine-dressed stone and that dressed by hand." The following is an extract from Mr. Carnegie's answer to this application:—

> "In the first place, looking at the Report of the engineers (Messrs. Carmichael and Kerr), it will be seen that the wages of the people employed in dressing 4,400 feet, amounts to 6*l*. 15*s*. 6*d*.; this includes the wages of all employed in laying on, dressing, turning, and taking off the stones, and also the wages of a person employed in repairs and the construction of additional machinery. To the above may be added for coals 15*s*. (our local situation enhances this item considerably), and for interest of fixed capital, and wear and tear about 2*l*. The calculation will then stand thus:—

Wages	£6	15	6
Coals	0	15	0
Interest	2	0	0
4,400 feet, at........	9	10	6

> about four-tenths of a penny per foot. It is more difficult to state what the exact cost of dressing the same stones by hand would amount to. I may say, however, with perfect safety of being within the mark, that the stones in question could not have been dressed by hand at less than four times the cost by the machine, and that this

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* We are authorised by the patentee to state, that if any proprietor or lessee of a quarry, who may be desirous of trying the applicability of the machine to any particular species of stone, will forward a block of it in a rough state (carriage free) to Mr. Hunter (Leysmill, near Arbroath), it will be returned to him planed and polished, along with an accurate report of the time occupied in the work, power applied, wear of tools, &c. Or, parties sending to Mr. Hunter two blocks capable of being turned into vases, according to patterns or drawings sent therewith, will receive in return one vase along with a report, &c. free of charge.

is rather below than above the ordinary rate of difference.

"It was purposely left to the engineers to take their choice of any of the machines, as they found them in the ordinary course of working, no notice having been given to the men, nor any preparation made. As it happened, the stones in hand came from one of the most indifferent strata of the quarry, and the results shown came proportionately below the usual average.

"Had it been thought desirable to show off the machine to the greatest advantage, it might easily have been done, and without the slightest deception, very different results might have been brought out. Thus, on account of their great weight, large stones such as landings, grave-stones, &c., are previously squared in the quarry; when laid on the level, therefore, they fill accurately all the space the machine traverses.

"Suppose such a stone, 12 feet long by 6 broad, and 8½ inches thick, and that it were required (an ordinary case) to be reduced to 7 inches in thickness. I am quite safe in saying, that the machine will do this in forty minutes, leaving the surface so smooth, that 9*d.* in hand-labour would bring the 72 feet to a perfect polish.

"Estimating as above the cost of working four machines for sixty hours at 9*l.* 10*s.* 6*d.*, forty minutes of one machine would amount to 6*d.*, but say an hour or 9*d.* as the cost of hewing 72 feet by the machine, that is about one-eighth of a penny per foot.

"To bring the stone to the same state by hand, the mason would require to go over it with four operations. He would, to speak technically, 1st, 'dab it over rough with a puncheon;' 2d, 'broach it close with a puncheon;' 3d, 'scabble it with a chisel;' 4th, 'angle drove it for polishing.' In this state, in consequence of the bruising operation of his chisel on the face being greater than that by the machine, it would cost twice as much to polish it. The cost of the above four operations, at the lowest estimate, would be 2½*d.* per foot. Thus the cost of hewing by hand and by machinery, would, in this case, be as 20 to 1.

"In estimating the outlay by the machine, ample allowance is made for the handling of the stones, the chief expense in the wages of the extra people attached to the mill, while nothing is charged for the assistance the mason would undoubtedly require in setting up and moving his stone. If this were taken into account, it would go far to double the comparative difference."

After receiving the above information, the Society thought the matter one of so much public importance, that they appointed a Special Committee of their number to repair to *Leysmill, to* "examine the machine in operation," and report the result of their personal examination. The Committee consisted of the following gentlemen:—

Lord Panmure.
Mr. Carnegie, of Craigo.
Mr. Hawkins, of Dunnichen.
Mr. Millar, of Ballumbie.
Mr. Proctor, of Halkeston.

This Committee paid a visit to the quarries, accordingly, on the 29th of June last, and the following is their Report to the Society:—

"With reference to the statements contained in a letter of date the 10th day of June current, from Mr. Lindsay Carnegie to the Secretary of your Society, your Committee are convinced that these statements are fully borne out, and beg to submit the result of their own observations—the following facts:—

"There were put upon the bed of the machine at the same time, three pavement-stones in a rough state and of unequal thicknesses; the first of which contained 12½ superficial feet, requiring to be reduced two inches in thickness; the second, containing 16½ superficial feet, requiring to be reduced three quarters of an inch; and the third, containing 18 superficial feet, and requiring to be reduced one inch and a quarter; the whole of which stone, amounting in all to 47 superficial feet, were reduced and polished in thirty minutes, including in this the time occupied in shifting the irons.

"Your Committee beg further to state, that with a view of comparing the working of the machine and hand labour, they interrogated Mr. Donald Mackay, master mason and builder, in Arbroath, who stated that to have accomplished the same work in the ordinary way by the hand, would have occupied a good mason five days and a half, at a cost of 15*s.* 9*d.*, according to the present rate of wages in this part of the country; whereas, according to calculations submitted by Mr. Lindsay Carnegie, and which your Committee have every reason to believe correct, the expense would amount to about 1*s.* 7*d.*

"In addition to the trial above noticed, your Committee saw stones, of the hardest quality, from different quarries in the country, dressed by the machine with a corresponding advantage; and your Committee cannot close this report without expressing their conviction of the great advantages to be derived from the extended operation of Mr. Hunter's machine, as being the means of preparing for the market as pavement, a quality of stone, which, without its assistance, could never be turned to account, as also the great saving to be obtained by its application to this hewing and dressing of all sorts of free stone.

"Your Committee beg leave also to report, that by the same steam-power they saw in operation the same principle applied as an experiment to a turning machine, from which they are satisfied that it may be applied with economy and advantage to the turning of stone vases, and other ornamental work."

"Leysmill, June 29, 1835."

The concluding passage of the preceding Report recalls to mind that we have yet one of the most valuable properties of this machine to notice—namely, that besides facing and dressing blocks of stone, it can be made (with the help of a lathe coupled to it) to turn, bore, and hollow them as well. Columns, ballisters, vases, drilled chairs and sleepers for railways, &c., may all, by this machine, be produced with a degree of accuracy, despatch, and economy, wholly unattainable by hand labour. We mentioned in our notice of the last Meeting of the Institute of British Architects (vol. xxiii., p. 349), one remarkable proof of this, which Mr. Carnegie presented to that Society, namely, a handsome vase turned out of the solid block, in the course of a single day's work, twenty inches high, and eighteen across the mouth. But this is nothing, we find, to what Mr. Hunter is making preparations to accomplish in the course of next winter's leisure. He talks with great confidence of being able to produce vases four feet high!—exact copies of our finest antiques, in all but the ornamental tracery, which must still remain to be done by hand. Of the ease with which holes might be drilled in stones by such combined machinery, the following extract from a letter, which we have seen from an eye-witness, furnishes equally striking evidence. He is describing a first trial in boring made by Mr. Hunter. "The stone," he says, "was old quarried and of the hardest yolk, and 5½ inches thick, the bore 1¾ inch diameter, and the time in going through the stone was exactly 2½ minutes; *it ran through it like wood.*"

The Arbroath stone on which Mr. Hunter's machines have been hitherto chiefly employed, has been long in great request for foot-pavements, market-places, kitchen-floors, &c.; and now that it can be produced by means of machinery in any quantities, will probably become still more and more so. It possesses this great advantage over the Yorkshire flag, that it resists the damp much better and dries more quickly; while it is, at the same time, equally cheap. In this point of view it has but one rival, the Caithness flag, to which however it is, in uniformity and homogeneousness of texture, vastly superior. In Scotland this species of stone, painted and varnished, is now getting into extensive use as a substitute for marble; it is a great deal more durable than Scagliola, and not half so expensive.

WILLIAMS'S SELF-INFLATING LIFE-BUOY.

It is well known to all who have witnessed shipwrecks, that instances sometimes occur where it is very difficult, if not impossible, for a boat to come close to those in distress; such as a reef of rocks, sand-banks, or a heavy surf breaking over the wreck. It has been suggested, that in such instances a communication might be effected by a boat anchoring as near as possible to windward, and veering away a light buoy and line to be carried to leeward by the wind to those in distress, who might, by these means, be hauled through the surf into the boat. An objection of some little weight was started as to the difficulty of stowing away in a life-boat (already filled up with air-cases,) a buoy of sufficient size and buoyancy to be strongly acted on by the wind. A self-inflating life-buoy made of India-rubber has, therefore, been contrived, which, when out of use, admits of stowage into a small compass, and is speedily available without complexity or difficulty on the part of the crew. The inventor is the Rev. Dr. Williams, of Llanfair Ynghornwy, Anglesey, Secretary to the Anglesey Branch of the Royal National Institution, for the Preservation of Life from Shipwreck. Dr. W. directs that "when the buoy is wanted you are to unscrew the vent, pass the becket or loop at the lower end over your foot or thawl-pin, or any thing handy, and extend the buoy by means of the upper becket, taking care that the vent is *fairly open;* as soon as it is extended to the utmost, screw down the vent, when the buoy becomes ready for use. The whole operation is easily effected in ten seconds." Dr. W. further recommends, that a light Manilla should be used, as having "more tendency to float, and being less kinky than hemp when wet,"

SOWERBY'S PATENT IMPROVEMENTS FOR SECURING SHIPS' WINDLASSES.

Fig. 1.

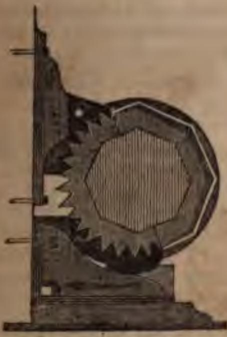


Fig. 2.

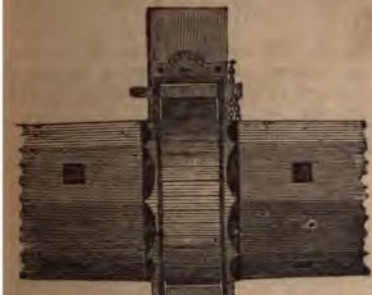
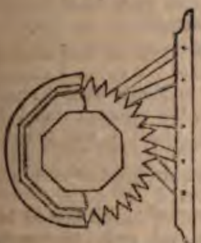


Fig. 3.



Sir,—Many nautical men having complained of the want of publicity of my patent windlass in some of the distant ports, whilst it is being so generally adopted and appreciated in those where it is known, I will feel obliged by your inserting the accompanying description of its construction, action, and advantages, in your widely-circulated and valuable Magazine. As the safety of both life and property, as well as the quick performance of a voyage, so often depends upon the security and efficiency of a ship's windlass, improvements in its construction are of great importance to all connected with shipping, and, consequently, to a numerous class of your readers; to such the following may be found interesting, and for them it is more particularly written by,

Yours respectfully,
Thomas Sowerby.

Patent Windlass Works, near Shadwell
Dock Basin, London, Oct. 7, 1835.

Fig. 1 is a section of the windlass body and side-view of the iron cylinder, which is firmly wedged thereon, with part of the flange broken off, to show the position of the patent iron pall and riding-chock when riding at anchor. The pall and riding-chock are each made on the segment of a circle, with teeth on their concave sides corresponding with the teeth on the cylinder.

Fig. 2 is a front view of the same, and part of the windlass body; also of the wedge bolt, which is inserted above the pall to lock it when riding. The pall-plate is bolted to the pall-bit, and has a bolt passing through its flanges, by which the pall is guided when working. The shoe or deck plate is also bolted to the pall-bit, and, through a timber, to the deck, and has a bolt through its flanges for guiding the riding-chock, also a slit parallel with the deck for guiding the bolt passing through the wood or riding-chock wedge.

Action and Advantages of the Patent Pall.

Before getting the anchor, the riding-chock is ungeared from the cylinder by driving out the wood-wedge by a short crow or lever, and the lock-bolt is withdrawn from above the pall. When the windlass is hove round, the pall rises and falls perpendicularly in the succession of the teeth on the cylinder, thus palling at once every tooth on nearly a quarter of its circumference. It thus offers a more solid resistance than a series of palls, such as have been commonly used, and which are shown at fig. 3, and its action against the pall-bit is much nearer to the deck. It cannot possibly trip or be upset, as, from its wedge-like form, it becomes but more firmly fixed as the strain increases. Neither is it injured by screwing or otherwise straining the deck-timbers, but fits alike, however the windlass is raised or depressed; on which account it has proved particularly valuable to ships carrying wool, hemp, and other screwed cargoes, from many of which the common palls had been taken out. If the cable ride, or a handspike foul, the windlass may be immediately run backward by lifting the pall. It is always in full pall, and to meet a sea, or for riding or veering the cable, it may be instantly converted into an efficient riding-chock by inserting the lock-bolt, which effectually prevents the windlass from being moved either way.

Of the Riding-Chock.

For riding, the pall being locked, the riding-chock is raised by a lever, and the wood-wedge driven in until the chock is firmly geared with the teeth on the cylinder. By this simple and quick operation, the windlass becomes a complete fixture with the pall-bit and deck, which cannot be moved whilst they remain fast, as it is secured alike in every direction, being literally embedded in iron. It is so readily applied, that the windlass may be chocked or unchocked instantaneously, and at any time, as the pall and chock fit alike to every part of the cylinder. It does not strain the windlass from the pall-bits, like the common wood riding-chocks, but supports it to the pall. It occupies less space, and allows the windlass to be made shorter, if required.

The whole apparatus can be applied to any ship's windlass, and at a less expense than the common palls and wood riding-chocks. It is more easily fitted, and not liable to get out of repair; and is peculiarly adapted to the use of chain-cables. It has already been adopted on board of vessels from 30 to 960 tons register, including East and West Indiamen, English and foreign traders, steam-packets, cutters, &c.; and the reports of the many intelligent and experienced commanders who have it in use, and who have put it to the most severe and complete trial, are at once gratifying and conclusive as to the many great and important advantages it possesses. In short, all agree in allowing it to combine compactness, cheapness, and security.

HALLEY'S COMET.

(For the Mechanics' Magazine, Oct. 17.)

Extract of an Ephemeris lately issued from the office of the *Nautical Almanac;* computed upon the former elements, only adding 9 days to the perihelion.

Mean Noon at Greenwich.

	Rt. Asc.			N. Dec.		
	h.	m.	s.	°	′	
Oct. 10,	10	44	37	63	23·6	
—— 12,	13	45	45	57	13·2	(perigee.)
—— 14,	15	27	55	40	23·4	
—— 16,	16	14	1	25	3·9	
—— 17,		27	42	19	11·2	
—— 18,		37	57	14	22·5	
—— 19,		45	52	10	26·0	
—— 20,		52	4	7	11·5	
—— 21,		57	0	4	29·4	
—— 22,	17	1	3	2	12·7	
—— 23,		4	22	0	16·8	
				S. Dec.		
—— 24,		7	3	1	23·0	
—— 25,		9	16	2	50·0	
—— 26,		11	8	4	5·9	
—— 27,		12	39	5	13·1	
—— 28,		13	52	6	12·8	
—— 29,		14	51	7	6·7	
—— 30,		15	37	7	55·6	
—— 31,		16	13	8	39·8	

Mr. Woollgar's anticipation that the comet would pass north of the quadrilateral of the Great Bear has, it will be observed, been fully verified.

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PERILOUS BALLOON ASCENT.

Mr. Clayton, the western aeronaut, narrowly escaped a sudden and violent end, during a balloon ascension which he made on the 21st August at Lexington, Ky. He had risen to an elevation of about two miles, when the perilous occurrence alluded to took place. We subjoin his own account of it.—*American Railroad Journal.*

"At twenty-three minutes after five, when at an altitude of two miles, I discovered that the gas had completely filled the balloon, and that the neck had become entangled between the cords by which I was suspended, preventing the surplus gas from escaping, and confining the valve-cord so that I could not open the valve.

"I immediately busied myself in liberating the valve-cord, and while in the act of doing this, the neck and cord were snatched with violence from me, the upper portion of the balloon burst with a tremendous noise, and I and the whole fabric fell two or three hundred feet, with the velocity of a stone. The rapid descent was then a little checked; and now the most critical moment of my life was at hand—a moment that required calmness, presence of mind and activity, for an awful scene presented itself. The lower part of the balloon, by the violent resistance of the atmosphere, in descending, had been pressed against the surface of the net-work, and formed into a parachute, of about twenty-five feet in diameter; but through the centre of this imperfect parachute I could behold the naked valve, the small meshes of the net, and a great portion of the silk on each side, which formed the resisting surface, hung in ribbons, dashing from side to side, and producing a noise like that of shattered sails of a ship in a tempest. This hurricane noise was not produced by the rapid descent alone, but by the violent oscillatory and rotary motion of the parachute. At one moment I was almost in a horizontal line with the parachute, and then I was dashed through the air to a level on the opposite side; thus describing an arc of nearly a semi-circle, the radius of which was about fifty feet; and at the same time I and my car were whirling with sickening velocity.—While in this situation I succeeded in dashing overboard all my bags of ballast, which weighed about 80 lbs.

"In four minutes I descended about a mile, and reached a region of dense clouds. At this time I untied the upper end of my cable and held it in my hands, threw over my anchor and allowed it to swing at the full length of the rope (150 feet); it was thrown at every vibration far above the level of my car.

"On passing beneath the cloud, I saw the town of Athens a little to the south-west of me. In five minutes more I reached the ground with a pretty severe shock, but sustaining no injury worth mentioning. The whole balloon or parachute, was instantly flat on the ground, a mass of ribbons. A few dark faces (negroes) appeared at a short distance from me, with outstretched hands—screaming—frightened to death at the huge machine that came whirling over their heads, and still more frightened when they saw me spring out of it."

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MR. HERAPATH'S FORMULA FOR VELOCITIES ON INCLINED PLANES.

Sir,—I am afraid Mr. Herapath's bed for some time to come will not be a bed of roses; but he has made it for himself, and must, therefore, try to repose himself upon it in the best way he can. Although he can scatter censure in every direction without either measure or mercy, yet he is himself so very thin-skinned as to take offence at any expression that can in the slightest degree be supposed to call in question his own infallibility. In his rather intemperate reply to Mr. James Combe, C. E., he describes the *red-shanked and breekless clan* (to which I myself am not ashamed to own I belong), "as coming from the North in shoals, like herrings, with *tartan petticoats*, &c. Again, in No. 2 of his series, p. 167, vol. xxiii., in speaking of the opinions of men of science, he says, "there are some with whom a *good fee* will always procure a *good opinion*, and even prove that the steeper and more difficult is the easier line to be worked." I think we may, without uncharitableness, conclude, that there is just as much ground for ascribing to any section of our men of science a greater regard for fees than facts, as for the alleged want of breeches' pockets to hold them. I do not believe there is a single man of science, whose opinion is worth having, who would, for the sake of a few pounds, give an opinion which he knew, in his own mind, to be erroneous. Such random imputations and such coarse language, are but ill calculated to promote the interests of truth and free inquiry.

Mr. Herapath, in addition to his great mathematical attainments must, I conceive, have some intimacy with the occult science; for I find, in No. 629, he states that the value of h in his newly-discovered formula, $\frac{30}{1 \pm \frac{h}{22}}$, when the plane descends, cannot safely be taken above 6 feet per mile, or one in 880. Now, in my last article, No. 634, which was written a considerable time before his, I requested him to give the greatest value of h, so that we might know when his formula presented a true or a false result. But be this as it may, we shall assume $h = 6$ feet. Will this value of h, according to his formula, produce a true result? Let us see.

$$\frac{30}{1 - \frac{h}{22}} = \frac{30 \times 22}{16} = 41\tfrac{1}{4} \text{ miles, ac-}$$

cording to Mr. Herapath's formula. But, from a rule derived from Nature's unerring laws, the velocity will be,

$$30 + \frac{\sqrt{2gh} \cdot 3600}{5280} = 30 + \frac{\sqrt{2gh} \cdot 15}{22}$$

$= 43 \cdot 39$ miles. So that it appears that Mr. Herapath is here in the dark as to the true value of h, since it can in one (and no more than one) case produce a true result, according to his own formula. This, however, may be obtained by assuming, $\frac{30}{1-\frac{h}{22}} = 30 + \frac{\sqrt{2gh}\cdot 15}{22}$, which equation by reduction becomes $h + \frac{44}{\sqrt{2gh)}}$ $\sqrt{h} = 22$, from which we find $h = \left(\sqrt{22 + \frac{242)}{g}} - \frac{22}{\sqrt{2g}}\right)^2 = 7\cdot 63$ feet, or 7¼ feet nearly. From which it appears that Mr. Herapath's formula for descending planes is only true in one single case, that is, when the fall is 7¼ feet per mile.

In his last article he seems to have some doubts of the accuracy of his formula for ascending planes, and he has endeavoured, by a kind of patchwork, to make it better. But on this subject I shall not at present enter, but reserve it for another communication.

Yours, &c.

IVER MACIVER.

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NOTES OF A TRAVELLER ON AMERICAN STEAM-NAVIGATION.

(For the Mechanics' Magazine.)

Sir, — During my residence in the Western States of Amerca, I devoted some attention to fresh-water navigation, a subject which is very little known in this country. In the newspapers, we frequently read accounts of the accidents produced by the bursting of the boilers of the Mississippi and Ohio steamers; and as often have these accidents, without any reason whatever, been attributed to the principle of the engines, *all* of them being high-pressure, though a few steamers are (or *were*) provided with condensers on the English plan. I say, all the engines are high-pressure; for the average working pressure of the steam is 135 lbs. on the inch; though many of the boats work regularly with a higher pressure than that, and but few with a lower. This, I am informed, is the average pressure to which the safety-valves are loaded; though when an engine is working properly, it occasionally blows off a little steam. Engineers like to see a puff now and then from the safety-valve, as it proves that every thing is going on well, and that the firemen are doing their duty. When racing the safety-valve is often loaded, or trod down, and the pressure is then unknown. I have seen tar and rosin thrown into the fire on these occasions; but though I have travelled many thousand miles in steamers on the great Western rivers, and made it a rule to inquire into *all* the accidents, explosions, &c. which occurred in the west for six years, I never knew of or heard of an accident to a boiler when racing; I also saw the answers sent by many of the steam-boat owners, captains, engineers, insurance agents, and so forth, to Mr Livingston's (late American Envoy to France,) queries, which were contained in a circular, requesting information on this subject, in hopes of his being able, when Secretary of State, to frame some law to prevent these accidents. All the answers contained similar statements, attributing *every* accident, with one exception, to the neglect of the engineer, in permitting the level of the water in the boilers to fall below the fire level, when the boat or boats were at rest. The exception occurred on board the Caledonia on her way from New Orleans. This explosion was attributed to the bottom of one of the boilers becoming red hot, from the immense quantity of clay which accumulated in them during their passage down the Ohio and Mississippi, and up the latter river, to a short distance of the mouth of the former. These rivers were very turbid, and such was the haste, that no delay occurred at New Orleans in discharging and taking in a fresh cargo, so there was no opportunity of clearing the boilers when the vessel was in that port. The person who put the new boiler in, assured me he felt quite certain that the accident occurred in this way.

I say that it is the general opinion, in which I concur, that the explosions and cases of collapse of flues, known to have occurred in these steamers, where the cause could be discovered, were traced to the engineer's permitting the water in the boiler to fall below the fire surface, when the vessel was at rest. Such rests are very frequent. They occur in putting passengers or freight ashore, or taking in passengers, freight, and fuel. The fire is kept up, though the engine is stopped; the steam passes off, and as the force-pump is not at work, the water quietly boils away until its surface falls below the fire level. The belt of iron above the surface of the water, and under the highest fire level, becomes red hot, and continues so until the boat is moved by the engine being set to work. The boilers first obey the movement of the boat, and are carried forward, the water in them remaining at rest, until it is accumulated in those ends of the boilers in the direction of the steamer's stern. The mass of water is now driven forward in the form of a wave by its own gravity, and passing over a red-hot surface, is in part decomposed and flashed suddenly into steam of very great elasticity. The joints also get an oblique strain at the same moment, the hot lap in contact with the water being cooled and contracted suddenly, while the under lap exposed to the fire is still hot. This must act as a sudden blow across the rivets, which occurring exactly at the moment of the sudden strain from the increased steam and free hydrogen, is doubtless the cause of the explosion. It is unnecessary for me to add, that no species of valve or fusible plate can protect or prevent such accidents as these. Legal or penal enactments, it is to be feared, will be equally useless, for the engineers are not deterred by the fate which surely awaits them in case of an explosion. Men will idle, sleep, drink, and talk with passengers. I have spoken to officers of steamers, and though they all admit the absolute necessity of a change in the regulation of the engineers, yet none of them would adopt the following suggestions, though all admitted the absolute necessity of something being done. The reader will readily comprehend why the suggestions were not adopted, when he is informed of the order or discipline and duty of the officers of a great Western steamer, several of which are above 900 tons' measurement, and one, the Homer, above 1,000 tons.

The first officer in command is the *captain*. His duty is to see that every person in the vessel, *except the engineer*, is attentive to his duty. He may advise —that is all.

The *pilot* who navigates and actually steers the vessel. The wheel is never out of his hand, or his assistants, the whole time the vessel is in motion. He rings the bell for the engineer to set the engine in motion (to go ahead), to invert the motion (to back her), or to diminish the speed, or to increase speed, or to throw one or both paddles out of geer, by means of a contrivance which I have only seen in the Western steamers. The pilot, too, has no control over the engines; he may complain of want of steam, or speed, to the captain, who may give the engineer some abuse, or report him to the owners, or in some cases dismiss him. It is an understood thing, that the pilot must not be interfered with by the captain, any more than the captain of a merchantman would be allowed to meddle with the sailing of a ship going into a harbour, after shipping a regular pilot.

The *clerk* is the captain's assistant. He takes his place in case of illness, death, or accident. His duty is to attend to the receipts and payments for freight; passage money; the landing and receiving of goods; the purchasing of wood for fuel; the ship's papers and accounts. He is also expected to mind that proper notice is given the pilot of the place to land, or take in, or put out passengers and freight, so that the vessel may be "rounded to" in safety, and brought alongside, or the boat rowed, as the case may be.

The *mate* attends to the crew on the forecastle, and as the fire-doors open on that part of the vessel, he has control over the firemen. The engineer may command them, but he generally gives the word to the mate or his deputy. The mate receives and stows the cargo; takes care that it is so arranged that the different parts are easily come at. He examines the pumps, the hold, and bottom of the vessel; he has the decks and roofs washed and swabbed down before sun-rise; he must also attend to live stock, and keep a look out for fire, particularly when cotton and other combustibles are above deck.

The *crew* are generally sailors who take a turn at fresh-water navigation for a season. Their duty is to attend to the mooring and unmooring of the steamer, parting the cargo, and so forth. They put passengers ashore in the boat.

The *firemen* are often slaves in the cotton boats, but in the upper boats they are generally Americans. Their duty is to feed the fires constantly, night and day. They also assist in cleaning the boilers and in taking in wood.

The deck passengers assist in taking in wood at the different stages; and in case of the steamers taking the ground, they are expected to assist in getting her off. For these services an allowance is made them in their passage-money.

The number of hands available in case of an emergency, is very great on the return trip from New Orleans of a large boat. The total number is sometimes about 1,000, and frequently above 500. It is quite a common occurrence for the captain to call the cabin passengers together after they have started, and their names, places of destination, &c. been entered, and request them to take into consideration the circumstances in which they are all placed, and the necessity of order and discipline being preserved, both in the cabin and steerage or upper deck. He concludes by moving, that three gentlemen be appointed by the cabin passengers from amongst themselves, to whom all quarrels and differences shall be submitted; these three to form a court for the trial of all offences which may occur on the voyage. The captain then retires, and the choice generally falls on persons who are well qualified for the task. The captain confirms all their decrees, and punishes by landing persons condemned, or puts them in irons, until he hands them over to the civil authorities at the port he is bound to. This court is extremely useful. It affords the cabin passengers amusement, and keeps the deck passengers in order. Indeed, its influence is incalculable. I have known cases of murder, robbery, crim. con., libel, &c. to have been tried by them, and perfect satisfaction given to all parties. This court relieves the captain of much trouble; if complaints are made to him of any particular person, he brings the parties before the court, and leaves them until the judgment is pronounced, which he generally confirms.

On board every steamer there is a carpenter and assistant; in large vessels a head cook and assistants, two or three stewards, and a woman in the ladies' cabin. In some there is a washerwoman, who assists in the ladies' cabin also.

The reader must now be aware of the immense number of human beings which are congregated in the moving ark, and as the steam-boilers are placed on the deck, an accident or explosion must do great mischief. Hence the great necessity of care and attention on the part of the engineer, whose room and workshop is generally close to the boiler, so that he is sure to be killed or scalded in case of an explosion.

After giving the subject of the explosions of the boilers of the Western boats every consideration, and talking over the matter with different intelligent captains, engineers, and engine-makers, I was led to suggest the propriety of furnishing each boat with a cistern to hold a supply of water for two hours. This cistern to open by a pipe into one of the boilers at the proper water level. The cistern to be placed above the boiler. It would then act like a bird-fountain; and whenever the water in the boiler fell below the level of the pipe, that instant the water from the cistern would flow into the boiler until the proper level was established, and so on until the reserve supply was used. The gauge to this cistern to be so placed that the pilot could see it before he rung the bell for the boat to go on. I afterwards thought it better, because cheaper, to suggest the propriety of attaching two gauge-cocks to each of the side boilers by means of tubes cased in charcoal, which should be conveyed upwards to the steering-house, where they would be close to the pilot's hand; thus the pilot would be enabled to discover the level of the water in the boilers before he rung the bell, or the vessel was moved. Finally, I suggested that one tube and gauge-cock might be taken from each side boiler at the lowest *safe* water level, and carried up to the steering-house, to be always examined by the pilot before he made the signal for starting.

In this simple manner a check would be established on the engineer, by a person of known character, one who must be always at his post, and always alive to his duty, and, at the same time, much exposed to any casualty which should happen from the engineer's neglect, the pilot's station being immediately over the boiler.

The benefit of this arrangement was admitted, but nobody adopted it, though it would not have cost five dollars to make and secure the proper apparatus. The objection was more to the change of responsibility than to the apparatus.

The pilots would not like it; as it was, they thought they had quite enough to attend to.

As to the reserve cistern, it would cost too much, and it would be so much dead freight. It might be of use, where idle or lazy engineers were employed, but at other times it would be worse than useless. Under the circumstances, the parties entrusted thought it better to run all risks, and go on as before. Thus we see habits established and a mode of procedure confirmed in a few years; for it is only a few years since the first steamer floated on the Ohio, or any other Western river. The number now must amount to upwards of 300, and less than 400. Nearly all of these occasionally visit New Orleans.

I made a calculation from the tables in the insurance-offices, and think their number above 340. These boats are all built of wood. They are not coppered, for any kind of sheathing would be torn off by the drift wood, snags, and so forth. There was some expectation of iron boats being adopted when I left that part of America, but I have not been informed of any yet built.

If you think the subject worth public attention, I will continue it in my next, and give you details of the construction of engine, &c. &c.

Truly yours,

Edward Talebois.

[We shall have much pleasure in laying a continuation of Mr. Talebois's interesting correspondence before our readers. Mr. T. alludes in a postscript to "an outline of the Huntsman" as accompanying his present paper, but this we have not received. If it has miscarried, we hope he will oblige us with another.—Ed. M. M.]

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LONDON AND GREENWICH RAILWAY.

Yesterday the experimental running of the train of engines and carriages commenced at Deptford about 3 o'clock, and continued until 5, to the great delight and satisfaction of the multitude present, among whom were several foreigners of distinction and members of the Society of Friends. The Royal William engine, which appeared to be the favourite, led off a train of eight elegant carriages, containing nearly 200 persons, in very gallant style, from the High-street to the Grand Surrey Canal, at which place many gentlemen alighted to inspect the beautiful oblique elliptic arches over the canal. Every arrangement for the convenience and comfort of the visiters seemed to have been made, and the utmost order prevailed. We understand that it is the intention of the Directors to continue these trials every Thursday until the whole of the rails are laid, and the finishing touch given to the line to Bermondsey, which will be in a few weeks, when the travelling in earnest and for hire will begin.

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THE PATENT LAW AMENDMENT ACT.

The challenge which we threw out in our last Number to Mr. Archibald Rosser, to give the *name* and *title* of the patent which he alleged, in his letter to the *Times* dated the 5th of October, had been actually amended under the new Act, and also to describe the form of proceeding which he averred had been agreed on by the Attorney-General and Solicitor-General, has remained, as we expected, unanswered. And for reason good—no such *amended* patent existed at the time "*he* wrote," and no such form of proceeding had been agreed on. That we might be the better assured of these facts, we went on Saturday last (five days after the date of Mr. Rosser's letter) to the Inrolment-office, and there ascertained that there had not been at that time a single disclaimer or memorandum of alteration filed, or offered to be filed. We made inquiry, also, at the proper quarters as to the form of process alleged to have been agreed on, and found that that, too, was equally imaginary. We got a sight, however, of a paper headed "*Proposed* Form of Proceeding," the ink of which was hardly yet dry, and which was (we believe) on that day submitted for *the first time* to the Attorney-General and Solicitor-General. We were wondering who the *proposer* might be, when a little bird whispered into our ear that the "*Proposed* Form" came from the very Mr. Archibald Rosser who had affirmed that *all* was *agreed* upon ten days before, and that it had been concocted between this person and a clerk of the clerk of the Clerk of the Patents—the same high functionary, we presume, who appears, from a notice in the corner of the *Times* devoted to correspondents, to have sent to that journal an attestation of the truth of Mr. Rosser's most untrue story.

We shall make no comment on these facts, but leave them, and the conduct of Mr. Archibald Rosser's ally, to the impartial judgment of our readers.

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NOTES AND NOTICES.

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No. 637. SATURDAY, OCTOBER 24, 1835. Price 3*d.*

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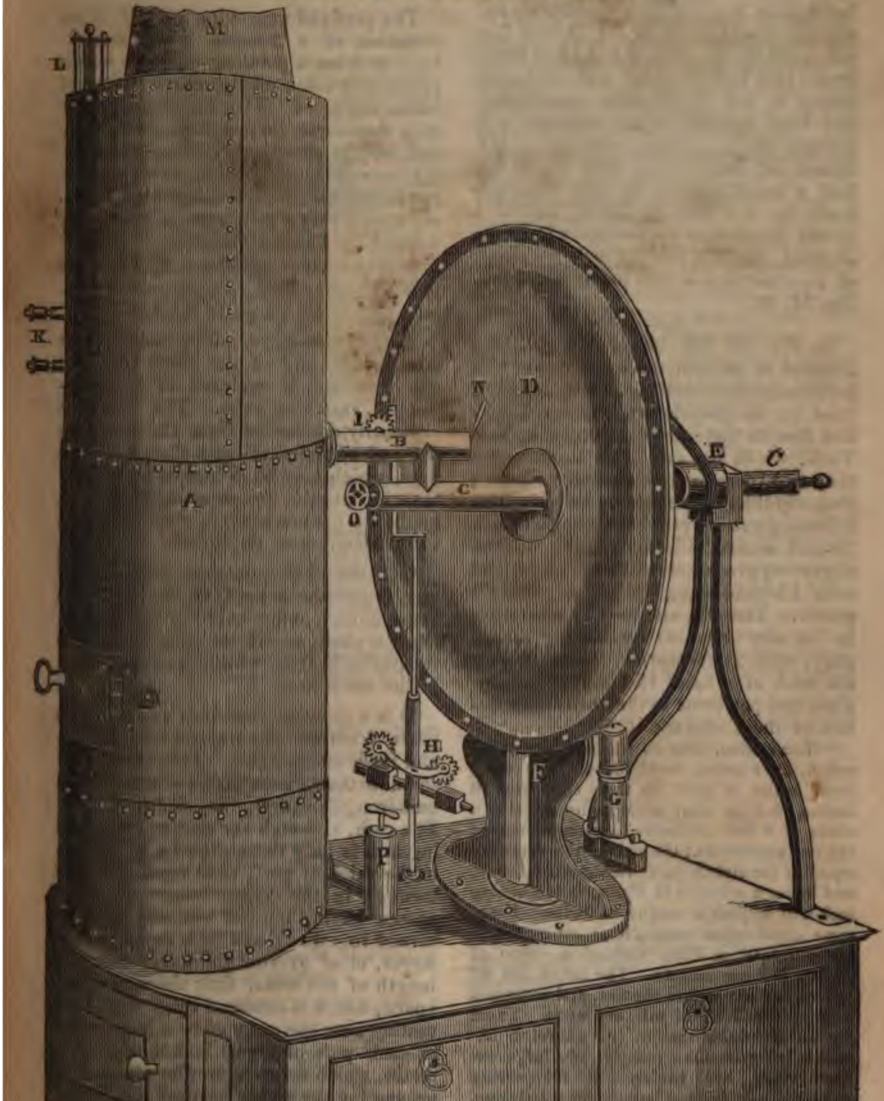

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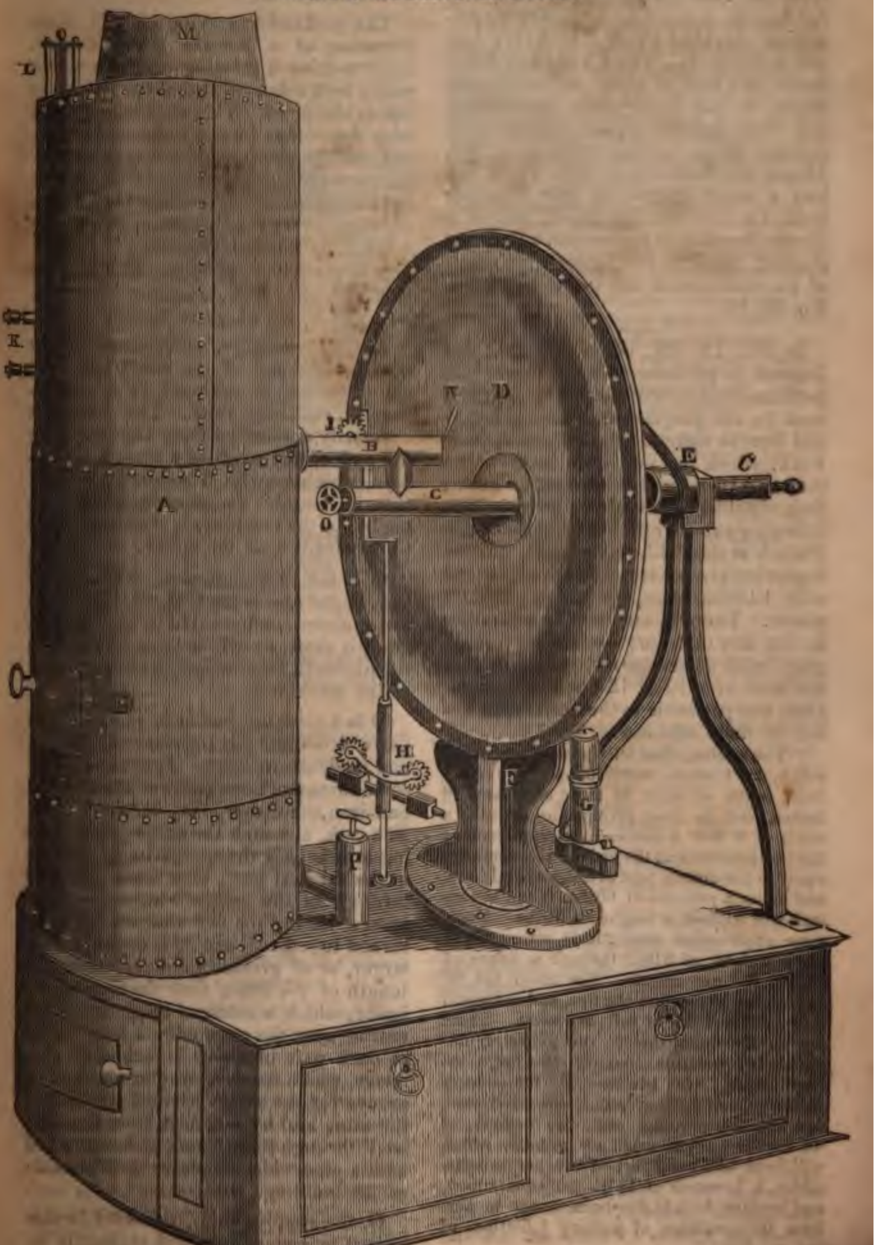

must have this new species of transit, and that therefore railways will go on progressing for many a year, until every link of the chain of internal communication is completed. Some think the present prejudice of the public in favour of railways is a mania. Let them think so; but it is a mania, like the astronomical madness of Copernicus, the more it is known the more it will be approved, and the better it will be supported; for it is a mania whose cause is necessity, utility the effect, and mankind the party to be benefited. It will therefore continue, the public being generally too wise to neglect what is found to be advantageous. Besides, if one portion of the country has a railway, another must in self-defence, or sink rapidly in prosperity. For since no place is independent, it flourishes or not in proportion to its absolute and relative facilities of communication with other places; and because railways are far too expensive to be constructed at every whim, there can be but little apprehensions of rivalry; so that the line, which is once judiciously planned, will be a source of permanent as well as considerable profit. The only thing to be feared is, whether advantage will not in too many instances be taken of the present prepossession of the public in favour of railways to foist on them bad and profitless schemes, to the prejudice of those that are intrinsically good. Some do really appear to carry absurdity to a most daring height. It seems as if to make a railway is all that is needful, without the slightest regard to end, object, or utility. I have one or two of this sort in view, which I am surprised and astonished can find supporters. Others again, notwithstanding every facility is given of a good construction, are purposely diverted from the natural course, without any regard to public utility, and even against it, to pass through the lands of an individual who wishes to have the benefit of a railway, and may have promised his Parliamentary influence, with, perhaps, to individuals, a *little more.*

Thus it is that private interest often mars public undertakings, though it must be allowed much more frequently produces and cherishes them. What, indeed, would the state of this country be, if it was not for the concentration of individual energies for private interest? As to patriotism in these matters, it is ridiculous to say otherwise, it is a mere name, a shadow the substance of which is private gain. Canvass the twenty-four millions of this empire; lay before them the paralyzing pressure of our national debt; and pourtray to them, in the most glowing colours that pen or pencil could, the advantages to the nation that would result from the paying of it off, and how few and small would be the voluntary contributions towards it, aye, or even towards the interest of it, if law did not compel them! But publish a prospectus of some new speculation, feasibly showing a profit of 10 or 15 per cent., and the capital, however great, will rapidly be raised, together with an equal or a double sum in the shape of premiums.

The effects of private speculation on the greatness and glory of this country, and many subjects connected with railways, are so very ably handled in a pamphlet just published at Effingham Wilson's, entitled, "A Few Cursory Remarks on Railways, by Thomas Hammond," that I cannot do better than refer my readers to a perusal of it. They will find a depth and justness of thought, and a force and vigour of expression, that rarely characterise the pamphlets of the day. The chief fault, in my opinion, lies in the strong political bias running through the work. I may be wrong, but I cannot see what works of public utility have to do with party politics, nor therefore why the advocates of those works should mingle the one with the other. However, the opinion of a man like myself, whose ruling maxim has always been, "*that every government has too many enemies for a prudent man to add unnecessarily to the number*," is not likely to be much followed in the present day.

The Eastern Counties Railway.

This railway, which was projected last year, but from some electioneering circumstances, was then prevented from proceeding, has been revived. It is proposed to start from the junction of Bishopsgate-street and Norton Falgate, and thence proceed by Romford, Brentwood, Ingatestone, Chelmsford, Colchester, Ipswich, Eye, to Norwich; and afterwards to Yarmouth.

I have been anxious to obtain the inclinations of this line, but have not succeeded, owing to the survey being now in progress, and, of course, not in a state to lay before the public. According, however, to the reports of the engineers, it appears that it can no where exceed about 13 feet a mile; and if so, must be extremely favourable for locomotive power. It is likewise to be free from lofty embankments, deep cuttings, and, above all, from those sad nuisances, tunnels.

One of the most remarkable features of this design, is that of the line of railway crossing the course of every river, except two inconsiderable ones, at right angles. There can, therefore, be no interference with the traffic of rivers, and hence no chance of opposition and interests clashing from such causes. On the contrary, the rivers running across to the right and left of the railway, will be so many tributary streams of traffic to it, both from the east and the west; and will consequently give it an extension of breadth not common to railways. The goods they bring from the interior may be rapidly transported to the capital without the risk and loss of time consequent on a sea-voyage; and those brought from the sea, or which happen to be wind-bound, may also be sent by the railway in less time probably than it would take the vessels to clear the rivers. In a similar way it will happen with goods brought by the railway, which will form the trunk of traffic, and the rivers the distributing branches. Instead, therefore, of being opposing quantities, as rivers and roads commonly are when they run parallel, they will here, like the hour and minute-hands of a watch, be independent indeed, but both conspiring to one object, the utility and perfection of the machine.

Another remarkable feature of this line, is that of its running nearly parallel to the road the whole of the way. There are but two places in which it deviates to any extent, a little to the north of Ipswich and north of Colchester. Of course, a more complete monopoly of the traffic of the road will be the consequence than usually happens to railways; for as to rivalry between roads and railways, when they come in competition, there can be none—either in speed or expense.

Of the Estimates of the Eastern Counties Railway.

It is a very general complaint, that engineers' estimates are almost ever beneath the actual cost; but here appears to be a most singular exception, at least in certain great items. For instead of the estimate being too little, it has every appearance of being much too great. This is, however, so good a fault, that one cannot be angry with the engineers. If a man has to pay 25*l* for an article for which he had agreed to give 20*l*, he feels vexed, and thinks he has been deceived, however good the bargain may then be; but if he has to pay 15*l*. instead of 20*l*., though the deception is the same in amount, he never complains nor murmurs against the man who has so pleasantly deceived him, but calls him an exceedingly good fellow. So here, I suppose, we must do the same; but let us to the point.

The distance from London to Yarmouth by the proposed line is 125 miles. At 30 feet wide we should have 3·6 acres to the mile; but for the purposes of embankments, cuttings, and approaches, we may set it at 6. Then $6 \times 125 = 750$ acres for the whole line; say, by way of allowing liberally for depots, 800. Now, gentlemen who well know the value of land on this line assure me it is exceedingly poor, and not worth more than from 20*l*. to 30*l*. per acre. Taking it, then, at double the higher sum, or 60*l*., we shall have $800 \times 60 = 48{,}000$*l*., or, in round numbers, 50,000*l*. for the total cost of the land.

Again, for the compensation to occupiers and owners, we cannot surely estimate it at more than our liberal estimate of the land; it is often calculated at a half or two-thirds. These two items will then make 100,000*l*. instead of 250,000*l*. given in the engineers' estimate. Deducting the difference, 150,000*l*., from their total estimate, 1,322,860*l*., excluding contingencies, leaves 1,172,860*l*. Adding to this, 10 per cent. for contingencies, the usual allowance (our very liberal engineer allows 277,140*l*.), gives about

1,320,090*l*., or 280,000*l*. less than the engineers computed.

On what scale the other items are calculated it is impossible to tell without the section and farther data; but if the same system is pursued, one may fairly conclude the line would not much exceed 1,000,000*l*., or two-thirds of the engineers' estimate. This, in comparison of the known expense of other lines, would certainly be very low.

The Revenue.

It is customary with engineers to take credit in their estimate of revenue for some 30, 40, or 50 per cent increase on the existing traffic, which experience has shown the introduction of railways induce. What, however, is here done? The existing traffic is stated to be 1,124,280*l*. annually; and instead of increasing it, credit is taken for only 421,890*l*., little better than one-third of what there is now stated to be. Yet on this high estimate, and this unparalleled diminution of revenue, they talk of a dividend of 15 per cent. profit.

No person can tell the credit due to the data on which the existing traffic has been computed, except him who has collected them; but if they are entitled to any reliance, the favourable result of two calculations made so decidedly against the project, is a proof of merit which richly deserves to be inquired into. Indeed, it was this very singular point in the prospectus which first attracted my attention. For if, while other parties use every means of lowering their estimates, and take credit for presumed increases of trade in order to make out a profit, the engineers here greatly overrates their estimates, and much underrate the existing revenue, it appeared to me to be a project with claims on public patronage much better founded than numbers of others now in the meridian of prosperity.*

JOHN HERAPATH.

Kensington, Oct. 1835.

MECHANICAL ANALYSIS OF THE BUCKINGHAM PLOUGHING MATCH,

September 23, 1835,

BY MR. WILLIAM ANDREWS, LAND-SURVEYOR.

No. of Land.	PROPRIETORS.	FURROW.			Draught of Plough in Cwts.	Proportionate Effect in super. inches per Cwt.	Time in h. m.	Speed in Miles per Hour.	OBSERVATIONS.
		Width in inches	Depth in inches	Area super. inches					
1	Mr. Thomas Bartlett..	8	4	32	3½	9·15	2 25	2¾	Prize { Man £1 0 Boy 0 5
2	Rev. J. L. Long......	8	4½	36	3¼	11·10	2 20	2½	
3	Mr. John Sear	8	3½	28	3	9 33	2 15	2¾	
4	Rev. Mr. Young	8	3½	28	3½	8·	2 15	2½	
5	Mr. John Bennett....	8	4	32	3	10· 6	2 15	3¼	
6	———	—	—	—	—	—	—	—	
7	George Parrott, Esq.	8½	3½	30	4	7· 5	2 25	2½	
8	Mr. Isaac Hurst	8	3½	28	3½	8·	2 10	2¾	Prize { Man £3 0 No driver.
9	Mr. John Brickwell ..	8	3½	28	3	9 33	2 0	2¾	
10	Mr. Jacob Hurst	7½	3½	26	3	8·66	2 25	2¼	
11	Mr. Edmond Walker	8	3½	28	3½	8·	1 50	3½	
12	Mr. John Brickwell ..	8	3½	28	3	9·33	2 18	2¾	
13	Mrs. C. Brickwell ..	8	3½	28	3	9·33	2 10	2½	
14	———	—	—	—	—	—	—	—	
15	Mr. Roper	8	3½	28	3½	8·	2 17	2¾	Prize { Man £2 0 0 Boy 0 7 6
16	Mr. T. Swain	8	3½	28	3½	8·	2 20	2¾	
17	Mr. Fountain	9	3½	31½	5	6·30	1 55	2¾	

The lands were as near half acres as the field would admit of to set out equal quantities. It was a light gravelly soil.

In the afternoon a meeting was held at the Town Hall, when a great number of prizes were distributed to agricultural labourers and servants, both male and female.

One aged man had lived in servitude on one farm sixty years. Two others had been in servitude fifty years each, similar to the one above.

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* See Notes and Notices in last page.

OBSERVATIONS ON THE PRACTICABILITY OF GUIDING AND DIRECTING AIR-BALLOONS OR AERIAL SHIPS.

Sir,—The discovery that heavy bodies might be raised in the atmosphere by confining gas specifically lighter than the common air in a thin envelope, was first made by Joseph and Stephen Montgolfier, paper-makers at Annonay, near Lyons, in the year 1782. Since that time up to the present, a period of fifty-three years, the science of aerostation has remained almost stationary. Various attempts have been made from time to time to turn balloons to some useful account; but the means hitherto adopted, when put to the test of experiment, have universally failed. This result is to be attributed, in a great measure, to projectors being led by the analogies of marine navigation, without considering that the cases of a ship in the water and a balloon in the air are wholly dissimilar.

It would require more time and space than can be afforded at present to give a full and comprehensive view of the two cases, so as to convince those who entertain an idea that balloons may be conducted by means of sails, that their opinion is founded in error. Those who have informed themselves sufficiently upon the subject know, that by the action of the wind upon the sails propelling the vessel in one direction, and the action of the rudder *in the water* holding the head of the vessel in another direction, a middle course is obtained, which enables the seaman, even in contrary winds, by tacking about to steer his vessel to its destination. A very little consideration will show that these means are not applicable to balloons, because in the latter case the sail and rudder are both acted upon by one force, and, consequently, a middle course between two acting forces cannot be obtained.

The next mode of conducting balloons that presents itself, is the use of oars or mechanical wings, attached to the body of the balloon or to the car. Here a second force is introduced; and although the power thereby obtained may not be sufficient to urge the balloon forward against a brisk wind, yet by these means, however inadequate, the balloon is not wholly at the mercy of the wind, but is to a certain extent under the direction of the aeronauts. But there are some serious objections to the use of mechanical wings. When the stroke of the wing has been made, it must necessarily be brought back to its former position before another stroke can be made. This occasions a loss of nearly one-half the time, and, consequently, of nearly one-half the power that might be employed in propelling the balloon. Besides this very serious loss of power, we must take into consideration the re-action caused by the pressure of the wings against the air whilst being brought back to their former position. The wings of the aerial ship are provided with moveable flaps, which fly open and allow the air to pass through in making the back stroke. This contrivance diminishes the loss caused by the re-action of the wings to a certain extent, but does not remove it altogether; the flaps must be opened by the pressure of the air, and therefore a very considerable loss still remains.

Besides these objections to the use of mechanical wings we must add, that the mode in which they are necessarily worked being an alternating motion, is the most disadvantageous application of power that could be adopted; because the impetus is destroyed at the end of every stroke, and the machinery for working them must be in some degree complicated, in order that the power may follow and adapt itself to the backward and forward stroke of the wings.

The same objections apply to the use of oars, except so far as regards the machinery; but whatever superiority oars may have in this respect, it is fully counterbalanced by the disadvantages of the situation in which they are used, so that the power obtained with oars and mechanical wings is very nearly equal. M. Blanchard made an experiment with wings and a rudder in the year 1784, but he found they were a mere incumbrance. In the same year, MM. Demonceau and Bertrand tried the use of oars, which they thought gave them some power, but the effect was so trifling that the experiment was not followed up.

There is another form of mechanical power applicable to the propelling of balloons so much superior to oars or mechanical wings, and at the same time so simple and so obvious, that it is a matter of wonder how any other means came to be attempted. This plan consists of a pair of paddle-wheels, of a form similar to those of a steam-vessel, made of light frame-work, and covered with glazed calico, or any other light covering. They should be fixed upon one spindle, extending across the car, and the spindle should be cranked in the middle to form a handle, which might be conveniently turned by the persons standing or sitting in the car. This mode is simple; it requires no complications of machinery; it gives the greatest amount of power that can be obtained, and by the simplest means, because the paddle-wheel gives a *continuous propelling power*, and the mode of application allows the whole disposable force of the aeronauts to be continuously exerted—and by the men standing opposite to each other at the crank, their power may be exerted under the most advantageous circumstances. But it should be observed, that the paddle-boards, or parts covered with calico, should be constructed somewhat after the fashion of Morgan's patent paddle-wheels, so that in the upper part of the wheel the edge of the paddle-board should be presented to the wind; otherwise, the upper part of the wheel, as it moves in the contrary direction, would entirely neutralise the effect produced by the under part.

In the *Morning Advertiser* of July 13, this plan was recommended by me to the conductors of the aerial ship, for which, however, I claim no merit, as a mode so simple and obvious must readily suggest itself to any person who might chooset turn his attention to the subject.

But there is one very weighty objection which I am afraid will prove fatal to the use of mechanical means of every description, which is this, that the resistance to be overcome must always be greater than the power that can be obtained by mechanical means to overcome it. An examination of the following table, first given by Mr. Smeaton in the *Philosophical Transactions* for 1759, and since confirmed by the experiments of Dr. Hutton, is essentially necessary to a right understanding of this part of the subject. It exhibits in pounds avoirdupois the pressure which winds of different *velocities will exert upon a square foot of surface exposed directly against them.*

Velocity of Wind.		Force on one square foot in lbs. avoirdupois.	Character of the Wind.
Miles per Hour.	Feet per second.		
1	1·47	·005	Hardly perceptible.
2	2·93	·020	Just perceptible.
3	4·40	·044	
4	5·87	·079	Gentle, pleasant wind
5	7·33	·123	
10	14·67	·492	Pleasant, brisk gale.
15	22·00	1·107	
20	29·34	1·968	Very brisk.
25	36·67	3·075	
30	44·01	4·429	High winds.
35	51·34	6·027	
40	58·68	7·873	Very high.
45	66·01	9·963	
50	73·35	12·300	Storm or tempest.
60	88·02	17·715	Great storm.
80	117·36	31·490	Hurricane.
100	146·70	49·200	Destructive hurricane

It should be noticed, that if the wind and the body move in the same direction with the same velocity, there is no resistance, for no air is displaced by the body. This is the case of the common balloon that is driven by the wind. If the wind move 15 feet per second and the body 30 in the same direction, the body meets a resistance equal to the pressure of a wind of 15 feet per second. If the wind and the body move in contrary directions with a velocity of 15 feet, the resistance is that of a wind of 30 feet per second. If a body is at rest and the wind moves, or if the wind is at rest and the body moves with equal velocity, the resistance is the same in both cases.

With these considerations, and comparing the size and form of the balloon with the foregoing table, we shall be enabled to form a tolerably correct judgment of the resistance that is to be overcome. The balloon cannot be pronounced an object of utility, unless it can be propelled against a wind of 15 feet per second, with a velocity of 15 feet, that is equal to a pressure of 30 feet per second.

According to MM. Biot and Thenard, 1,000 cubic inches of dry air, the barometer standing at 30 inches, and Fahrenheit's thermometer at 60°, weigh about 311 grains; a cubic foot contains 1,728 cubic inches, and will therefore weigh about 536 grains. Now, as carburetted hydrogen, when purged of its impurities, weighs a little more than half the same volume of atmospheric air, it appears that we may calculate upon half an ounce of buoyancy for every cubic foot of gas that is employed. A cube of 27 feet contains 19,683 feet, and, according to the foregoing data, will carry a weight of about 615 pounds. This is nearly the weight of a balloon of these dimensions, with the car, rudder, paddle-wheels, and two men. Now, as a wind of the velocity of 30 feet per second presents a pressure of about 2 pounds upon each square foot, it follows that the side of a cube of 27 feet will meet with a resistance of 54 pounds; but if this cube be reduced to the form of an oblate cone, the resistance will be very much diminished. The lateral edges of the cone should be made as thin as possible, because the pressure of the wind comes upon it sideways, and this form will present the smallest surface, and it can be extended horizontally to any reasonable extent without increasing the resistance; and, further, if the end of the cone, which is to be presented to the wind, is brought down with a sharp curve, the resistance will be reduced comparatively to a mere trifle, perhaps not more than 10 or 12 pounds. But notwithstanding this reduction in the resistance, the difficulty is by no means removed, because the paddle-wheel has to be turned in the direction of the wind, which is blowing at the rate of 10 miles an hour; consequently the periphery of the wheel must be turned at a rate exceeding 10 miles an hour, before an ounce of power can be obtained. There is no doubt that this speed, and even a much greater, can be attained, but to accomplish this the wheel must be of large diameter. It would be difficult to obtain a sufficient degree of speed with a wheel of less diameter than 20 feet. Two men might turn such a pair of wheels perhaps with ease if standing on *terra firma;* but it is very doubtful whether they could do so standing in the car of a balloon, and it is very certain that they could not work them effectively for any length of time, because a resistance of 10 pounds upon the periphery of a wheel of 20 feet diameter would give a resistance of 100 pounds on the crank or handle, which is more than two men standing in the car of a balloon could overcome for half an hour together. The matter is not mended by increasing the number of men, because, as the body of the balloon must be enlarged to carry the additional weight, the power and the resistance are both increased *in the same ratio. If oars or wings are used the case will be a great* deal worse, because the paddle-wheel gives a power almost three times as great as oars or mechanical wings.

These objections to the application of mechanical means first led me to consider whether a sufficient power could not be obtained by attaching a number of birds of the larger species to the balloon so as to draw it along. I am aware that it will be objected to this mode that the power of a bird on the wing is so small, that it would require a great number to produce any considerable effect. This must be admitted: but the value of this mode over every other consists in this—*that the power may be increased to any amount without necessarily increasing the resistance*, because the bird sustains its own weight by the power of its wings; therefore, whatever number of birds may be employed, the balloon does not require to be enlarged. This is a very great advantage. Eagles, hawks, or falcons, are the birds which I propose for this purpose; they are remarkable for their intelligence and tractability, which enabled the falconers to train them for the ancient and noble sport of hawking. But in the present case very little training is required, because they may be attached to the balloon in such a manner that they must of necessity all pull in one direction, and they can easily be directed in the course that the aeronaut wishes to steer. But the power to be obtained by the use of birds is much greater than might be supposed by persons unacquainted with the subject. An eagle will seize in his talons, and carry off without difficulty, a hare or a fowl weighing from 6 to 8 lbs. Now, if he can *carry* 8 pounds, we may safely estimate that he can *draw* an equal weight; but in order that we may be doubly safe, we will estimate his drawing-power at 4 pounds, so that from 20 eagles attached to a balloon we obtain a power of 80 pounds. If 20 were deemed insufficient, 20 or 30 more might be added; this number can be conveniently attached to a balloon carrying two persons, the pressure upon which is 10 or 12 pounds, so that we have a power of 200 pounds to overcome a resistance of 10 or 12. But I am of opinion, that the falcon is to be preferred for this purpose, on account of his prodigious swiftness; and although he is not so strong as the eagle, this can be compensated by attaching a greater number. The following instances of the speed of the falcon seem almost incredible :—

"Montague, in his Ornithological Dictionary, has the following instructive particulars on this subject :—'The rapidity with which a falcon flies in pursuit of its quarry (the bird pursued) is inconceivably great. The flight of a strong falcon, says Doctor Shaw, is wonderfully swift. It is recorded that a falcon belonging to a duke of Cleve, flew out of Westphalia into Prussia, in one day; and in the county of Norfolk, a hawk has made a flight at a woodcock near thirty miles in an hour.'

"But what are these compared to the actual velocity and continuance of the flight of a falcon, which is recorded to have belonged to Henry IV., King of France, which escaped from Fontainebleau, and in twenty-four hours after was found in Malta, a space computed to be not less than 1,350 miles! a velocity equal to fifty-seven miles an hour, supposing the hawk to have been on the wing the whole time. But as such birds never fly by night, and allowing the day to be at the longest, or to be eighteen hours light, this would make seventy-five miles an hour. It is probable, however, that he neither had so many hours of light in the twenty-four to perform the journey, nor that he was taken on the moment of his arrival, so that we may fairly conclude much less time was occupied in performing that distant flight.

"Those who have attended to the flight of birds, know that a sparrow will fly at the rate of more than thirty miles in an hour. It is, indeed, extremely difficult to ascertain the actual distance a falcon may fly in a given space of time, when in pursuit of its quarry. But Colonel Thornton, speaking of the rapidity of the flight of a falcon in pursuit of a snipe, estimates the space of nine miles in eleven minutes, independent of the numerous turns; and the force with which they strike, in the utmost of their velocity, is so great, that the colonel has known a hawk belonging to him cut a snipe in two parts.

"The rapidity with which a hawk, and many other birds, occasionally fly, is probably not less than at the rate of one hundred and fifty miles an hour, when either pursued or pursuing, and their powers fully exerted; and certainly one hundred miles is not beyond a fair computation for migratory continuance, not only of the hawk, but of the woodcock, snipe, and other similar birds. Amongst quadrupeds the horse is, perhaps, as fleet as any, and yet the velocity falls very short of that of a bird; the famous racer, *Hambletonian*, covered a space of four miles in eight minutes, which is but thirty miles an hour, if it could be continued. *Eclipse* is said to have gone at the rate of a mile in a minute for a very short distance."—P. 182, *Rennie's Edition*, 1831.

All things being considered, I think that something useful may be accomplished by the power of birds, and that little or nothing can be done by mechanical means alone. If it were desired to raise the effect to the highest possible pitch, we might put all our means in requisition, and avail ourselves of the power of the birds and our mechanical resources at the same time. By these combined means a balloon might be propelled in any direction with a very great velocity in moderately calm weather.

I am by no means of opinion, that all the means and appliances here recommended are the very best that could be devised. Very far from it; I know that in every unexplored path of art or science we must advance progressively by slow degrees, a little at a time. These observations have been offered merely to show, that if the attempt be made in a proper manner there is a reasonable chance of success. It ought to have a fair trial; if nothing is attempted, nothing can be done. Let it once be established that balloons can be conducted with some degree of certainty, and it will soon be discovered that they are objects of considerable utility. I could point to a variety of situations in which they might be useful as a means of transit, when no other could be made available, especially in a time of war in carrying dispatches or intelligence across a country occupied by the enemy. The safety of an army often depends on the speedy transmission of intelligence, when all the ordinary means for effecting that object are cut off. They might also be the means of splendid and rational amusement to the noble and affluent; and on that account alone, if they had no higher recommendation, they are worthy of attention. They are surely capable of producing an excitement as lively and lasting, and much more elevated, than that produced by the race-course, to which so large a share of the attention and means of our nobility are directed. A race between two balloons might be as readily got up as a race between two horses, by which means pleasure and science would be made to advance hand in hand—the passion of the sportsman and the philosopher might be gratified at the same time. There are many other considerations which render the balloon an object of interest; and I cannot help thinking that those who are in possession of ample means might enlarge the sphere of their own gratifications, and confer a benefit on science, were they to devote a small portion of those means to its improvement.

The objection, that balloons cannot be conducted against a high wind, is of little weight. The same objection may be urged against ships, which cannot be steered against a high wind; but surely no one will be so simple as to say that therefore we ought to abandon the use of ships. In one respect the balloon has a decided advantage over the ship—the former can soon reach a place of safety, which the latter cannot do at all times. Neither is the objection with regard to the expense of much value; modern discovery is not asleep, and means may be discovered that will reduce the expense to a mere trifle. Let the first great obstacle be overcome with regard to the means of conducting, and all these objections will shortly disappear.

But it is said, "Oh! it is such a foolish thing to attempt to turn balloons to any useful purpose—it cannot be done—and he who makes the attempt will only get laughed at for his pains." He must be a sorry projector, indeed, that will allow himself to be frightened from his purpose with this sort of logic. Almost every improvement that has been made in the arts, and every discovery in science, has been for a time assailed by the ridicule of the world. There is a set of people who feel a deal of pleasure in detracting from the merits of every laudable undertaking. It is their whim—not a very generous one, truly, but let them enjoy it; it would be a sin to subtract a tittle from the enjoyments of such poor, miserable creatures. The following extract from a popular writer of the present day shows, in a clear and striking manner, the spirit with which improvements in the arts are generally received by the world:—

"The history of the steam-engine, and of its application to the purposes of navigation, furnishes an instructive instance of the incredulity, indifference, and positive hostility, which the most useful inventions sometimes experience from the world at large. A plan for propelling vessels in this way was projected a century ago by Jonathan Hulls—experimented upon, *neglected, and forgotten.* The idea was again suggested fifty years ago, to Mr. Miller of Dalswinston, by his tutor, Mr. Taylor;—was tried, and found fully answerable to the most sanguine expectations; but, from a series of unfortunate circumstances, was again laid to sleep. On this occasion, however, the sleep was not fast. Symington, an ingenious engineer employed by Miller, persevered, through good report and bad report, in experimenting,* and his machinery, being seen by Fulton of New York, and Bell of Helensburgh, was eventually the model of the first steam-boats set agoing by these individuals respectively, on the Hudson and Clyde. It can never be forgotten, however, that Fulton was laughed at as a madman for his attempt; and that Bell for many years was pitied as a poor and crazy projector, and, in the latter part of his life, to use the language of the Quarterly Review, 'only saved from starvation by the charity of the public.'

"Gas-lighting was first practised in Cornwall about the year 1792, by an ingenious and modest man named Murdoch. In the year 1803, the late Mr. F. A. Winsor took up the invention, and set about the business of demonstrating its practicability to the public. After a series of experiments at the Lyceum in the Strand, after lighting the walls of Carlton Palace Gardens in St. James's Park, after lighting one side of Pall-Mall by pipes from his own house, and thus spending *eight years* among the most enlightened and speculative people on earth, he was still disbelieved. A friend in Edinburgh mentions to us that he well recollects, about five-and-twenty years ago, hearing Sir Walter Scott describe to a party of Scottish barristers an interview which he had had in London with 'a man who proposed to light London with coal-gas.' 'To light London with gas!' repeated Sir Walter, with a hearty laugh. 'A madman!—and a serious madman too; one of those dull ones who are quite in earnest—the most hopeless of all!' And he again uttered a loud laugh, in which all his listeners cordially joined. In 1812, London *was* lighted by gas, as it has ever been since; and in 1825, the Author of 'Waverley,' who had scouted the project with such inconsiderate, and, we may venture to say, ignorant ridicule, not only had his own house lighted in this manner from top to bottom, but was president, and took an active hand in the proceedings, of the Edinburgh Oil-Gas Company."—*Chambers's Edinburgh Journal, No.* 165.

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* We must here take leave to refer Mr. Mackintosh and the reader to some observations in our 19th vol., p. 121. &c., from which it will be seen that this is but doing inadequate justice to Symington, whose merits as an original inventor were of the very highest order.—Ed. M. M.

To these instances we may add the case of those ill-used individuals who are at present struggling through all manner of difficulties to bring to perfection steam-carriages to run upon common roads. I might adduce another instance from my own personal experience. It has been my fate (for I think it must be fate) to introduce several improvements in machinery, and the only return that I have received therefrom has been loss of property and distraction of mind.

The general rule seems to be, that whoever attempts any new and striking improvement in mechanical art must expect to experience the following treatment:—At first when he exhibits his designs the world will ridicule and laugh at him for his folly and presumption. When his plans are nearly completed, he finds himself ruined by the expense, and his health and spirits broken by the difficulties he has had to contend with, and which were not anticipated at the commencement of his undertaking. The generous world now looks upon him with a mixture of pity and contempt. The poverty-stricken and broken-spirited projector now sinks into the grave, and leaves his invention all but complete. His "traps" are now brought to the hammer, and that which cost years of labour and months of intense study, night and day, is knocked down for a trifle as so much lumber, the crude productions of a crack-brained projector. This falls, perhaps, into the hands of an enterprising individual, with a full purse, and a mind fresh and vigorous, who examines it and sees that it is nearly perfect, immediately sets it in motion and reaps the advantage. Then the magnanimous World becomes wonderfully loud in her wailings for the untimely fate of an unfortunate genius; and it not unfrequently happens that those who were the first to scoff at and deride the "unfortunate genius" step into the field, at the eleventh hour, and enrich themselves with the spoils of the dead. I cannot say that there is much encouragement to be derived from these extracts and reflections; however, it is the fiery furnace through which all projectors must pass; and he who has the talent or the fortune to make good his passage, is sure to arrive at wealth and honourable distinction.

Hoping that these remarks may have a tendency to induce those who may possess the competent means and ability to turn their attention to the subject,

I remain, yours respectfully,
T. S. MACKINTOSH.

Sun Tavern, London Wall.

P. S.—Any person may make an experiment upon this plan with a paper balloon and pigeons at a trifling expense; in attaching the birds care must be taken to preserve the balance of the balloon, and the orifice at the bottom must be left large as a precaution against fire.

OPINIONS OF COUNSEL ON THE PATENT LAW AMENDMENT ACT.

When we mentioned (last vol. p. 524) the doubts which were entertained respecting the sufficiency of that part of the late Patent Law Amendment Act, which relates to disclaimers and memorandums of alteration, we stated that a Case had been prepared for the opinions of the Law-Officers of the Crown on the subject, which, along with these opinions when obtained, we would lay before our readers. It was afterwards thought, that as the doubts raised related to the powers conferred by the Act on the Attorney-General and Solicitor-General, it would be more discreet to take the opinions of some other gentlemen eminent in the law than of those officers themselves. The Case prepared was accordingly submitted to Sir Frederick Pollock (late Attorney-General) and Mr. Steer, whose opinions on it we now subjoin.

Both the learned Counsel, it will be seen, think that the Act does give the Law-Officers of the Crown the power of authorising disclaimers and alterations; but that in cases of an opposition, the authority conferred on them falls short of what is in *all other cases* supposed to be necessary to the ends of justice.

CASE.

By the statute of 5 and 6 Will. IV., cap 83, clause 1., it is enacted, that "any person who as grantee, assignee, or otherwise, hath obtained or shall obtain Letters Patent for the sole making, exercising, vending, or using of any invention, may, if he think fit, enter with the clerk of the patents of England, Scotland, or Ireland, respectively, as the case may be, *having first obtained the leave of his* Majesty's Attorney-General or Solicitor-General in case of an English patent, of the Lord Advocate or

Solicitor-General of Scotland in the case of a Scotch patent, or of his Majesty's Attorney-General or Solicitor-General for Ireland in the case of an Irish patent, *certified by his fiat and signature*, a disclaimer of any part of either the title of the invention or of the specification, stating the reason for such disclaimer, or may with such leave as aforesaid enter a memorandum of any alteration in the said title or specification, *not being such disclaimer or such alteration as shall extend the exclusive right granted by the said Letters Patent*; and such disclaimer or memorandum of alteration being filed by the said clerk of the patents and enrolled with the specification, shall be deemed and taken to be part of such Letters Patent *or* such specification in all courts whatever. Provided always, that any person may enter *a caveat*, in like manner as caveats are now used to be entered, *against such disclaimer or alteration*; which caveat being so entered shall give the party entering the same *a right to have notice* of the *application* being heard by the Attorney-General or Solicitor-General or Lord Advocate, respectively." And it is further enacted, "that it shall be lawful for the Attorney-General or Solicitor-General or Lord Advocate, before granting *such fiat*, to require the party applying for the same to advertise his disclaimer or alteration in such manner as such Attorney-General or Solicitor-General or Lord Advocate shall seem right, and shall, if he so require such advertisement, certify in his fiat that the same has been duly made."

Previously to the passing of this Act the Law-Officers of the Crown had no jurisdiction in the matter of granting patents beyond that of reporting to the Crown on the propriety of granting them, on special reference being made to them for the purpose; their reports might either be acted on or not, as his Majesty's Secretrary of State, for the time being, should advise; and even when acted upon as far as the Great Seal, the whole proceedings could be quashed by appeal to the Lord Chancellor.

By the present Act, it seems to have been *intended* to invest the Law-Officers of the Crown with the sole and absolute power of sanctioning the amendment and alteration of Letters Patent after they have been once granted, and of the specifications of the same; not only so, but to allow of no appeal (in this case) from their decisions.

As this is a power of an entirely novel and somewhat extraordinary description—which, to be exercised safely and usefully, must be exercised with great circumspection—it becomes important to ascertain—first, Whether such a power has been actually conferred by the statute; and second, whether the means of exercising it justly and fairly have been provided.

First, as to the power conferred. The Act, it will be observed, does not *in express terms* confer any such power on the officers of the Crown; it only speaks *narratively* of the party desirous of disclaiming or altering, "*having first obtained* the leave of his Majesty's Attorney-General," &c.—assuming, as it were, that the Attorney-General, &c. had previously the power of granting such leave.

Second, As to the means provided, of exercising the power justly and fairly, supposing it to have been actually conferred by the statute. The right to disclaim or alter is made subject to this condition, that the disclaimer or alteration must be such as shall not "*extend the exclusive right*" granted by the original Letters Patent. The Act, however, seems to provide no adequate means of ascertaining and deciding whether the intended disclaimer or alteration will have such an effect or not. For, first, the objection to give a *sufficient reason* is confined by the words of the Act to the case of a disclaimer; and a person desirous of entering a memorandum of alteration, may do so *without assigning any reason whatever*. Secondly, though it is provided, that a *caveat* may be entered against every such application, and that the person entering it shall have "*notice* of the application being heard;" it is no where provided that the person so receiving *notice* shall be *entitled to attend and oppose the application in person or by counsel*. And thirdly, there is no power of *examining witnesses on oath* given to the Attorney-General, &c.

That the 2nd and 3rd of these omissions are by no means immaterial, is to be inferred from other parts of the Act, which relate to applications to *his Majesty in Council* for new Letters Patent in certain cases, and for an extension of the term of Letters Patent in others. By clause II. it is provided, in the case of a petition for new Letters Patent, that "any person opposing the petitioner *shall be entitled to be heard* before the Judicial Committee of the Privy Council." And by clause IV. it is in like manner provided, that the petitioner for an extension of the term of a patent (or according to the literal interpretation of the *Act* THE *King!*) shall "give notice to any person or persons who shall have entered caveats, and further (such *notice* not being of itself sufficient to give a right to be *heard*,) that "the persons entering caveats *shall likewise be heard by their counsel and witnesses*." Either there was no occasion for adding the right to be heard in these two cases, or it seems to follow that the omission of it in the clause relating to applications to the Attorney-General, &c. should be fatal to the assertion of any such right before them.

It is further worthy of observation, that though the Act (clause I.) provides, that "it shall be lawful for the Attorney-General," &c., when he requires an advertisement of disclaimer or alteration, "to certify in his fiat that the same has been duly made," it is not provided that he shall certify any thing as to *the fitness of the disclaimer or alteration itself*.

If then there be no power of inquiring into the fitnesss of a proposed disclaimer or alteration, or of deciding upon it before granting the fiat, this, it is humbly conceived, must practically nullify the power of giving leave altogether. For it is not a power (supposing it to exist by inference from the language and spirit of the Act,) to give leave for the filing of *any* and *every* disclaimer or alteration, but of such only as shall *not* "extend the exclusive right" granted by the original Letters Patent.

Your opinion is therefore requested upon these points:—

1st, Whether the Act in question is sufficient to give to his Majesty's Attorney-General or Solicitor-General in the case of an English patent, or the Lord Advocate for Scotland in the case of a Scotch patent, or his Majesty's Attorney-General or Solicitor-General for Ireland in the case of an Irish patent, the sole and absolute power of giving leave to disclaim or alter the titles and specifications of inventions?

2nd, Whether, supposing the preceding question to be answered in the affirmative, the means are provided by the Act of administering such power justly and fairly, and whether in particular a party entering a caveat against a disclaimer or alteration will be entitled in virtue of the Act to be heard in person or by counsel, and by witnesses (sworn to speak the truth) against the application.

Opinion of Sir Frederick Pollock.

It appears to me that the Act in question does actually give to the Attorney-General, and the other public officers mentioned, the sole and absolute power of giving leave to disclaim or alter the titles of specifications of inventions *in those cases where such alterations can* legally *be made*.

The object of the first clause was to prevent the mischiefs that occasionally arose from the present very imperfect law of patents. One instance is presented in Brunton *v.* Hawkes (4 B and A, 541), where a most valuable patent was wholly lost, because being taken out for three distinct matters, it could not be sustained as to each, and the Court held it was therefore void. Had the patentee possessed the power of disclaiming, he might have given up the patent *quoad* the anchor (upon which he failed), and retained it *quoad* the cable, the important object of the patent; so where the title of the specification may be open to objection, the public officers may permit an alteration, and cases not unfrequently occur where such a power is almost essential to justice, and would most properly be exercised. I do not see any provision for an appeal or any control over the power of the public officers except this, that where the disclaimer or alteration has the effect of extending the patent, it is not sanctioned or authorised by the Act, and will be, in my opinion, wholly void; for instance, should a patentee apply for and obtain leave to alter the title and the specification of a patent, and the Court before whom the question should be raised, were to deem the alteration in substance and effect an extension of the right, then the memorandum entered with the clerk would be wholly void and inoperative.

2. I apprehend any party interested will be entitled to be heard before the Attorney-General, and to put him in possession of the merits of the case in the same manner as is now done upon questions of priority of invention; but witnesses cannot be examined upon oath.

FREDERICK POLLOCK.

Temple, Oct. 19, 1835.

Opinion of Mr. Steer.

The Act of Parliament in question is certainly not framed with that clearness and accuracy of detail which leaves no possibility of doubt as to the object of the Legislature, or the means by which that object is to be accomplished.

Still it appears to me quite sufficient—firstly, to vest in the Attorney-General, &c. the power to grant leave to patentees, &c., to disclaim or make alterations in titles and specifications in the manner provided.

And secondly, although the design and purpose of the Act is to protect and benefit patentees, the general interests of the public are not forgotten; and the right to enter a caveat being given to counteract any sinister or fraudulent use being made of the opposite right to disclaim or make alterations in titles and specifications. But wherever a conflict of these opposing rights takes place under the provisions of this Act, I think it is solely in the judgment and discretion of the Attorney-General, &c. to determine the dispute; and although it would be his duty to hear the parties, and he may, if he thinks fit, permit them to appear by counsel, I apprehend it to be quite clear, that he has no power to examine witnesses on oath, either for or against such an application. It is probable, that in most of the cases that came before him, no resistance to the application to amend or alter will be made; and where caveats are entered, unless by explanation and mutual agreement the differences can be obviated, I should presume he will leave the parties to their ordinary remedy in a court of law. It seems to me that something like this course is not very obscurely intimated by the Act itself, as it provides, that where any suit is depending touching the validity of a patent at the time such disclaimer or alteration is enrolled, the same shall not be used on evidence in such suit. Wherever, therefore, the parties before the Attorney-General, &c. appear to have merits respectively, which cannot be amicably settled, and which demand a solemn inquiry and determination, he will, doubtless, decline to give his fiat in favour of the application, and leave the party complainant to the ordinary remedy in such cases.

JOHN STEER.

15, Chancery-lane, Sept. 30, 1834.

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Mr. Archibald Rosser has replied, at last, by a letter in the *Times*, to our challenge, "to give the *name* and *title*" of the specification which he alleged (5th of October) had been actually "amended" under the new Act, and also "a sketch of the *modus operandi*" which he averred had been concurred in by "the Attorney-General and Solicitor-General." That Mr. Archibald Rosser may have the full *benefit* of his own words, we shall here insert the entire letter:—

"*To the Editor of the Times.*

"Sir,—I am truly glad to have an arena in which the Editor of the *Mechanics' Magazine* can be contended with on fair terms.

"The question is, whether, at the time this gentleman published (I will no longer say *wrote*, since he attributes to me a quibble on that account), a specification had been amended under the Act? I assert again, that a specification had been so amended; my authority is Mr. William Carpmael, of the Patent-office, who has more to do with the practice of patents than any man in the kingdom, and who, in a letter to yourself, which you did not think it necessary to publish, corroborated my assertion. I believe as firmly as that you exist, or I exist, or that the Editor of the *Mechanics' Magazine* is out of temper, that, if any thing remained to be done in the amendment, it was no more than, owing to the absence from town of the receiving-officer, tantamount to pitching a deed into your deed-box after you have got it perfected.

"Here I hope the discussion will terminate, so far at least as you have any control over it, till the working of the Act is seen. To me the contest is merely troublesome, but to the Editor of the *Mechanics' Magazine* it is profitable; it helps to fill and advertise his periodical, while I get nothing but my labour for my pains.

"Your obedient servant,

"ARCHIBALD ROSSER.

"15, New Boswell-court, Oct. 16."

Into what a contemptible, pitiable position, has this poor gentleman wriggled himself at last! Self-pilloried, both as an utterer (if not forger) of falsehoods, and as a prater about "free discussion," who cares no farther for it, than as it may bring grist to his six-and-eightpenny mill, or, as he phrases it, something else than mere "labour for my pains."

He is "truly glad," forsooth, to have "an arena to which the Editor of the *Mechanics' Magazine* can be contended with on fair terms." And as a *proof* of his gladness, he ends his letter with requesting that the said arena may be forthwith closed! Admirable consistency!

"To me," he says, "the contest is *merely troublesome*." He ought to have added, "and very damning."

"But to the Editor of the *Mechanics' Magazine* it is profitable." Yes, much in the same way as it may be said to be possible for a brave man to win laurels of a dastard, or for a lover of Truth to do her honour by arguing with a habitual liar.

"It helps to fill and advertise his periodical." It stands *so much in need* of filling and advertising! Much as we may be in want of matter to fill our columns—a want abundantly testified by the great deficiency in originality and variety so conspicuous in our twenty-three extremely thin and widely-printed volumes—Mr. Archibald Rosser can bear us witness that it has not prevented us from exercising our Editorial privilege of rejection, with a tolerable degree of freedom, whenever *self-advertisement and glorification* seemed to us to be the aim of a correspondent rather than the public good.

"The question," he says, "is, whether at the time this gentleman *published* (I will no longer say *wrote*, since he attributes to me a quibble on that account) a specification had been amended." No—this is not the question; he but substitutes one quibble for another. The real question is, whether the account which we published of what *previously* took place at the Attorney-General's-office, when we applied to enter a memorandum of alteration, was a true account or not. Mr. Archibald Rosser gave a flat contradiction to that statement. We stated that there were difficulties in the way; he denied that there were any. We said that no form of proceeding had been agreed upon; he affirmed, on the contrary, that the form had been agreed upon by both the "Attorney-General and Solicitor-General;" nay, that "*a specification had been* (*actually*) *amended under the Act*." And all this Mr. Archibald Rosser did for the gentlemanly and honourable purpose of injuring us professionally in public opinion—of making it appear that we knew nothing at all about a matter with which it was our business and our duty to be thoroughly acquainted. Let us now, then, see how he makes good his statements.

> "I assert again, that a specification had been so amended; *my authority* is Mr. William Carpmael, of the Patent-office, who has more to do with the practice of patents than any man in the kingdom, and who, in a letter to yourself, which you did not think it necessary to publish, corroborated my assertion."

So then, Mr. Rosser's bold, unqualified assertion, that a "specification had been (actually) amended under the Act," shrinks on handling into a mere hearsay! He is still as unable as ever to give either name or title or date or "modus operandi;" all he can do is to shift the story from himself to Mr. Carpmael, and there leave it. After what we have seen and experienced of Mr. Rosser's regard for veracity, we must have better testimony than his, before we can believe that Mr. Carpmael said any thing of the kind here ascribed to him. But whoever the author of the story may have been—whether Mr. Rosser himself, or Mr. Carpmael, the man of great practice—greater, it would seem, than even his respectable master, Mr. Poole—or any other clerk of the clerk of the clerk of the patents,—we must take leave on our parts to repeat, that it is wholly false. We again challenge all concerned to prove it any thing better than an impudent and audacious fabrication.

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NOTES AND NOTICES.

We regret that Dr. Lardner's correction of some errors in the Parliamentary Report of his Evidence on the Great Western Railway, which we lately published, did not reach us till at too late a period of the week for insertion in our present Number. It shall appear in our next.

An article full of valuable information on the Thames Tunnel, and in vindication of the projector and his patrons, is also necessarily postponed for eight days.

In our present Number there are some observations by Mr. Herapath, in his 13th paper on Railways, respecting the increased degree of favour with which such undertakings are now regarded in this country, that seem to us particularly deserving of attention. Mr. H. has also referred to one railway, in which the Editor of this Work is personally concerned, in such flattering terms, that it is due to him as well as ourselves to state, that we have the best of reasons for believing that when Mr. H. favoured us with his opinion of that railway, he was wholly unconscious of the share which the Editor had in its origination. We may add, too, as a matter necessarily within our personal knowledge, that it was not till *after* Mr. H.'s favourable opinion of the Eastern Counties Railway was in manuscript that he became, at our request, a member of the Provisional Committee for its formation.

New Street.—It is intended early in the next session of Parliament to apply for a bill to carry into effect the formation of a new street, commencing at Stamford-street, Blackfriars-road, and terminating at the Town-hall, Southwark.

Importance of Pure Air.—That the air is deteriorated by breathing, is generally known, but not *universally!* otherwise so many persons would not be careless of living, sleeping, and working in unventilated rooms, workshops, factories, and counting-houses. To tolerate about our person or habitation excretions of the animal economy is justly considered injurious to health, and repugnant to delicacy and cleanliness; it is not less so to inspire a contaminated atmosphere: for the *nutriment* of the air is quite as effectually extracted by inspiration as the nutriment of food is by digestion, and the residue in either case ought to be deemed equally offensive.—*History of the Middle and Working Classes, Second Edition.*

System of the Universe.—Minute as the changes are in motions of the planets from the constant operation of their reciprocal attraction, they might be supposed to accumulate in the course of ages sufficiently to derange the whole system of nature, to alter the relative positions of the planets, to put an end to the vicissitudes of the seasons, and to bring about collisions which would involve our whole system in chaotic confusion. It is natural to inquire what proof exists that nature will be preserved from such a catastrophe? Nothing can be known from observation, since the existence of the human race has occupied comparatively but a point in duration, while these vicissitudes embrace myriads of ages. The proof is simple and convincing. All the variations of the solar system are expressed analytically by the sines and cosines of circular arcs, which increase with the time; and as a sine or cosine can never exceed the radius, but must oscillate between zero and unity, however much the time may increase, it follows that when the variations have by slow changes accumulated, in however long a time, to a maximum, they decrease by the same slow degrees, till they arrive at their smallest value, and again begin a new course, thus for ever oscillating about a mean value.—*Mrs. Somerville.*

Mr. Barlow's reply to Mr. Beale in our next; also a few words from Anti-Carper to Iver M'Iver.

Communications received from Mr. Woodhouse—T. S.—Viater—Mr. Richards—Mr. Watson.

Errata, p. 44, column 1, line 4.—For $h + \frac{44}{\sqrt{2gh}}\sqrt{h} = 22$, read $h + \frac{44}{\sqrt{2g}}\sqrt{h} = 22$. Again, in the 6th line from the top, for 7·63, read 7·263.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price *6d.* Also, the volume complete, in boards, price *9s. 6d.*

☞ Patents taken out with economy and despatch; Specifications prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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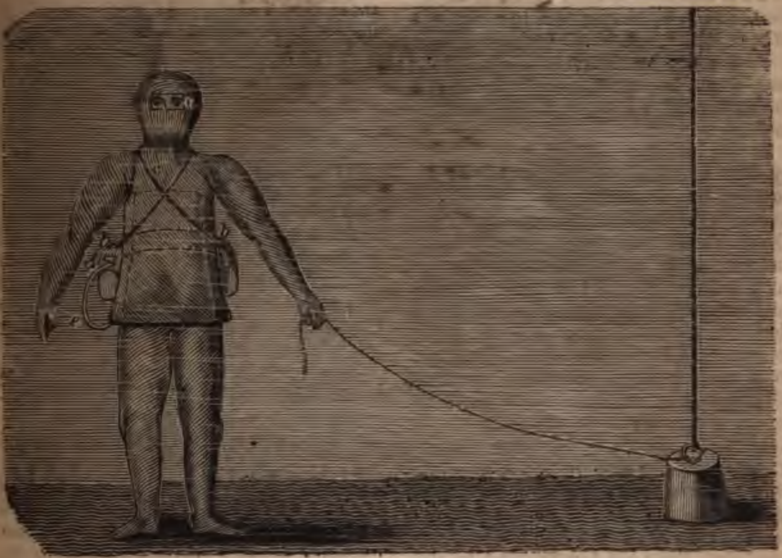
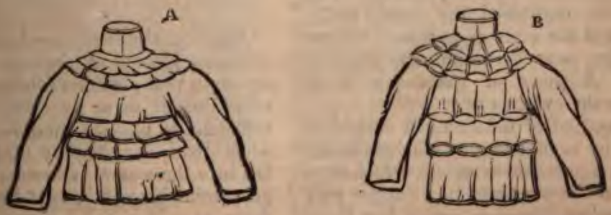
CONDERT'S DIVING-APPARATUS.



SELF-INFLATING DIVING-JACKET.



CONDERT'S DIVING-DRESS.

(From the *Franklin Journal*)

The diving-dress described in this communication, and the disaster connected with it, have been recalled to my recollection from noticing several recent patents for submarine apparatus. It appears to possess some peculiar features, and seems well calculated for small depth; no metallic or other inflexible material is used in its construction, or in connecting the two portions of it together. It is put on and off with the same facility as an ordinary dress; and when in use, the body is in full possession of its natural flexibility of motion.

It was invented, and frequently used, by Mr. Charles Condert, a machinist, employed in a factory opposite the East river, in Brooklyn, opposite this city (New York). In the docks adjoining the workshop he repeatedly descended in it, in from 16 to 20 feet water. While thus engaged in August, 1832, he fell a victim to his enterprise. The air in the reservoir had become expanded, or, from some accident, probably from his falling, it had escaped, as the tube which conveyed the air from the reservoir to the interior of the dress was found broken when hauled up. He was, of course, instantly suffocated. Like Mr. Spalding, the improver of the diving-bell, he perished in the bloom of life at a distance from his family, and in the prosecution of his favourite pursuits. This description of his dress will probably be the only memorial of this ingenious, persevering, and unfortunate mechanic.

The dress consisted of two parts, made of cloth, coated with gum elastic; the under part was a pair of pantaloons, with India-rubber shoes; this portion of the dress extended up to the arms, and was supported by suspenders. The other part embraced the head, arms, hands, and the body as low as the hips, descending over the pantaloons about 12 inches. A piece of glass was fixed opposite the eyes, as at *a*.

His method of obtaining a supply of air was by condensing a sufficient quantity into a portable reservoir attached to his dress. It consisted of a copper pipe *bb*, 6 inches diameter, and 4 feet long, closed at both ends, and bent like a *horse-shoe*. *Two or three staples* were soldered to the upper part, to receive hooks attached to the ends of the suspenders, or slings which supported it. Into this pipe he condensed, by a pump (formed of a gun-barrel), as much air as he supposed would be required for the time he intended to remain under water. A small valve-cock *d*, near one end of the reservoir, admitted air into the dress when required; by opening this valve a small pipe *e* from which entered two or three inches under the lower edge of the upper dress or jacket, where it folded over the under part. The air escaping from it, of course, entered the dress and kept it inflated, and prevented the water from entering it.

As the air was respired it ascended to the upper part of the hood or covering of the head, and escaped by a small aperture in the cloth about the size of a pin's head, or less. He intended to use a valve in its place, but found it to act tolerably well. His situation below could always be perceived by the people above from the air ascending perpendicularly over this orifice.

The round part of the reservoir embraced his back, and the two ends projected in front on each side of him.

When he descended, by a rope passed through a hole made in the bottom of the boat sufficiently large (about 2½ feet square), a 56-pound weight was attached to one end and suffered to sink to the bottom; another cord attached to it, and one end held in his hand, or fastened to his arm, served to direct him to a perpendicular rope when he wished to ascend.

The reservoir was loaded with about 200 pounds of lead; this load was placed too high—it would have been better to have distributed it about the legs and feet; the higher the load, the more difficult it is for the diver to rise if he should happen to stumble or fall.

T. E.

Note by the Writer.—Might not the ordinary jackets of seamen be so constructed, that portions folding over each other might form receptacles for air, sufficient to prevent them from sinking, when from accident or otherwise they fall into the water, as is shown at A; or perpendicular cells might be quilted on them, as at B, without materially changing the present appearance of the dress. In almost every position in which a person could fall into the water, some air would remain in these cells.

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DR. LARDNER'S EVIDENCE ON THE GREAT WESTERN RAILWAY BILL.

Sir,—The *Mechanics' Magazine* for the month of September having been just placed in my hands, I have for the first time seen what I suppose is a transcript of the printed Report of my evidence before the House of Lords. I perceive an error in the Report, which you would oblige me by correcting in your publication. In No. 632, p. 480, *Mechanics' Magazine*, I am made to say, that "if the train does not commence to move from the top of the inclined plane from a state of rest, we must add to the velocity acquired in falling from a state of rest the initial velocity." What I stated was this; that we must add to the square of the velocity due to the descent down the plane from a state of rest, the square of the initial velocity, and that the sum thus found will be the square of the velocity of the body at the foot of the plane.

In the particular case mentioned, the velocity at the foot of the plane would be 50 miles an hour, and not 66 miles an hour. This error in the Report probably arose from the words of the question put to me being given as my answer.

As you have thought it worth while to reprint a portion of the report of my evidence, I think it right to state, that I had no opportunity of correcting that printed Report. I left London in two hours after I quitted the Committee-room of the Lords to attend the British Association in Dublin, and since then I have not been in London, nor have I even seen the Report of my evidence until I met it accidentally in your publication. It is probable, therefore, that there may be many other errors, especially in the numerical tabular parts. Every one who has been accustomed to scientific publications must be aware how difficult it is to insure correcness in this respect—even when the proof sheets have all the advantage of careful revision by the author.

I remain, Sir,
Your obedient servant,
DIONYSIUS LARDNER.

30, Cambridge-terrace, Edgeware-road,
Oct. 22, 1835.

IVER MACIVER *versus* MR. HERAPATH'S FORMULA.

Sir,—Mr. Herapath ought to tremble —Iver Maciver I dare say thinks so—at the threat he has issued, that "Mr. Herapath's bed for some time to come will not be a bed of roses." Does Iver Maciver really think it is in the power of such a writer as he is, to make "Mr. Herapath's bed for some time to come not a bed of roses?" Before he undertakes this, I would advise him to go to the Temple of Truth, and study there a little; and afterwards to school for a few years, to acquire a little more of elementary mathematics.

Nothing, sir, is easier than for one man to deal out general invective against the writings of another. It is only when these carping pretenders come to deliver a little of their own, that the mist which conceals their want of knowledge is dissipated, and the profundity of their ignorance made manifest. Passing by Iver Maciver's assertions in his first and last paragraphs, which he knows, if he knows any thing, to be totally untrue, I shall stop at the first and only mathematical theorem he has ventured to give. He says, p. 43, "from a theorem derived from Nature's unerring laws, the velocity" of a locomotive train in miles per hour "will be

$$30+\frac{\sqrt{2gh}\cdot 15}{22},"$$

in which $g=32\frac{1}{6}$ and h is the perpendicular fall in feet of the plane.

Now, sir, being a plain man, fonder of deeds than words, I call upon Iver Maciver at once, *mathematically, to demonstrate, with reference to locomotive-engines*, and without *shifting* or *evasion*, this "theorem derived," as he says, "from Nature's unerring laws." Let him not imagine that I do not understand what his theorem means; a schoolboy in Iver Maciver's own country would deserve to have his tartan petticoats lifted, and the birch briskly applied, who could not see through it at a glance, as well as through its gross errors and glaring absurdity. Remember, Mr. Editor, it is the *mathematical proof* of this theorem's containing the *laws of locomotive-engines* I want, and pray don't fail to urge him to let us have it immediately — without *shifting* and without *evasion*, allow me to repeat. Before I dazzle the world with a display of his refulgent knowledge, I am anxious to amuse your readers with an analysis of the logic of this heretofore breekless gentleman, who conceitedly threatens "for some time to come to make Mr. Herapath's bed not a bed of roses!" As soon as he has done this, I have a few other things for him to do, and we shall speedily see how much he knows of "Nature's unerring laws," and which he is most like—a man capable of opposing Mr. Herapath in science, or a swaggering, Bond-street butterfly, who insults the man that has deigned to notice him kindly, and gets contempt for his impertinence.

ANTI-CARPER.

THAMES TUNNEL.

Mr. Editor,—A correspondent of yours, G. L. S., in No. 632 of the *Mechanics' Magazine*—a well-wisher evidently to the success of this great enterprise, condemning with justice the angry feelings expressed by some of your contributors against it, as attributable to personal motives, gladly and liberally offers a suggestion for the greater security of the work while in progress.

He says, that "*to sustain the pressure of the superincumbent earth, during the excavation, he would drive* 18 *inches apart, horizontally, before the shield, and in a line with the top of the brick-work, iron rods*, 1 *inch thick and* 8 *feet long, and that a sheet of iron one quarter of an inch thick should then be laid over every two of the rods; thus he would form over the shield a covering* (or ceiling), *which would be moved forward when a yard of tunnel is finished*."

Prompted, as he is, by a friendly disposition, it is presumed that he will be gratified by learning what the provisions of the engineer actually are for sustaining the pressure of the superincumbent earth, while the excavation is being made. He should first know, however, what the scale of the operation is.

The excavation made for the Thames Tunnel is about 38 feet in width, and 22 feet 6 inches in height, presenting, therefore, an opening exceeding 850 feet. The whole of this excavation, including its [illegible] which may be computed at 400 feet, is secured by means of a powerful apparatus designated the shield, as is also the roof of it, which measures 350 feet. At full tide the weight of both earth and water, which constitute *the superincumbent pressure*, is not less than 700 tons. This is the portion that has formed the subject of your correspondent's solicitude.

The *ceiling* of the shield consists of 24 or 26 pieces of cast-iron, denominated staves, closely adjusted; and as they are sometimes made to relieve each other, and therefore subjected to an increased load, they are for greater strength made like inverted troughs of cast-iron; their breadth is 18 inches, the depth of their sides 7 inches, and their length 9 feet, independently of a tail of wrought-iron which overlays the brickwork. The edges in front are made sharp for entering the ground, and the external surfaces of the staves are planed very true. Similar staves are laid against the sides of the shield, all planed and equally well adjusted; each stave can be impelled singly as sheet piles are. Upon the whole the shield may be viewed as a coffer-dam, which, instead of being moved in a perpendicular direction, is placed and is impelled horizontally. The standing part of the shield consists of 12 parallel frames, all independent of each other.

The front of this vast excavation is protected in a different manner from that of the sides. It is panelled all over with small boards, each of which is 3 feet long and 6 inches wide. There are, therefore, upwards of 500 of these boards, technically called *polings*, for covering the whole face of the excavation. Every one of these polings is held in place, and secured by means of two hand-jacks or screws, abutting against the frames. There are, therefore, upwards of one thousand of these jacks in action for securing the face of the excavation, or, rather, for pressing against the ground with sufficient power to prevent any disruption of its various strata; for were the ground to be at all deranged, the pressure against the sides and front of the shield might soon increase to 2,500 or 3,000 tons, independently of that of the superincumbent pressure.

It is further to be remarked, that every successive side, which at its full head is 76 feet above the foot of the excavation, causes an incessant variation in that pressure, tending to strain the hard strata, and to soften or knead the intervening soft ones; a fact quite unnoticed by projectors of plans, but which proved fatal to those who attempted the drift-way under the Thames in 1808. The pressure exerted against the front of the excavation by the agency of the shield, must therefore be uniformly kept at a maximum. The shield is advanced only 9 *inches* at a time, while the brick structure proceeds simultaneously.

Your correspondent, influenced as he is by the best motives, will have great satisfaction in learning, that the new shield is now being made without the necessity for modifying any law of hydraulics, or changing the nature of the ground, as has been too much the case with the various projectors who have sought to labour in the same field with the engineer of the Thames Tunnel.

Those who, without considering what must first be done under-ground, conceive that every difficulty would be obviated by some particular covering laid on the bed of the river over the tunnel, such as timber-flooring, rafts, planking, roofing, plates of metal of any kind, tarpaulings, sails, leather, &c., loaded over with some great weight, or not loaded at all, should further consider that they have, we are assured, upwards of 300 competitors for the same expedient, besides about 90 who, from motives of caution, have reserved the disclosure of their respective plans, until some remuneration should previously be provided.

It would be well if those who feel disposed to enter the List of Competitors were first to consult the report of those miners who directed the attempts that were made and carried on with so much perseverance, between the years 1803 and 1808, with the ultimate object of opening a roadway under the Thames at Rotherhithe. These were miners (Cornishmen), engineers in that branch of the art, and, consequently, eminently qualified for the task in every respect; they were as sanguine, too, as any of the projectors of this day; and their excavation was limited, in the first place, to a simple driftway, the height of which was only 5 feet, the breadth 2 feet 6 inches at the top, and 3 feet at the bottom, forming, therefore, an excavation that was sixty times smaller than the excavation which has been made for the Thames Tunnel. Diminutive, however, as this hole was when contrasted with that of the tunnel, the ground in the roof, though supported by substantial planking, gave way once in a fluid state, leaving an unsupported cavity over the roof of the driftway; still it held itself up; but a second accident of the same nature having occurred under a very high tide, the river broke the ground and entered the drift. In both cases it was the loose ground that forced its way first into the drift, and the river afterwards. The miners succeeded in filling the hole and in re-entering the drift, but the men could not continue the working; they were, according to the engineer's report, *driven out of it by the frequent bursts of sand and of water*, and it was acknowledged by him to be quite impracticable to proceed farther; so, after having probed the ground from underneath in many places, he concluded and reported that it was impossible to make an excavation of any size under the Thames. It never entered the head of this engineer, Mr. Trevethick, a remarkably ingenious and enterprising man, who conducted the operation to its final abandonment, that any covering, spread over the bottom of the river, would prevent the river filling his drift or a tunnel, at every tide, any more than it does the wells situated at many hundred yards from the river.

But he resorted to one expedient which he conceived would answer the emergency—one which, at any rate, demonstrates the intrepidity of this engineer. That is, in order to clear or pass through the place which had been filled up in closing the hole made by the breaking in of the river, he reduced the height of his drift from 5 feet to 3 feet. The men and the engineers, too, had therefore to work on their knees. Awful enough for such a task! Thus reduced, the area of the excavation of this drift hardly exceeded the one-hundredth part of that of the Thames Tunnel under corresponding circumstances.

Any one can form an idea of a hole three feet square by looking at some garret-window; but not so easily of a hole of a greater sectional area—for example, than the old House of Commons was.

It is no absurdity, Mr. Editor, to have succeeded in cutting out a hole of larger area than that hall, under a head of water as high as the Custom-house. The engineer who has made it never, however, professed being a miner, and never excluded miners, or any person interested professionally, from a sight of his works.

Let us farther notice here what Mr. Vazie said, who was not only the colleague of Mr. Trevithick, but the directing engineer, so far at least as the first 392 feet of that drift. In his letter, by way of appeal, to the proprietors, dated the 7th of December, 1807, relying, as he somewhat emphatically assumed it, "*on his professional information in the art of mining*," he stated, "*I am bold to say, that the only material difficulties with which we have had to contend have arisen from not having had the 50-horse steam-engine*," which had actually been purchased at his suggestion, and for which a 14-horse power had been substituted. He then adverts to "*such an enterprise as that of working underneath a river so deep and so rapid as the Thames*;" and boasts of having, nevertheless, "*succeeded in defiance of difficulties pronounced insurmountable by several engineers*." In another part of his letter he adds, "*I have been repeatedly, laboriously employed* THROUGH THE NIGHT *without taking any refreshment; and it was by no means unusual for me to remain 40 hours without rest; and for upwards of four years and a half* I DID NOT SLEEP ONE NIGHT FROM THE WORKS—*I am proud to state this, &c.*"

And all these arguments were from practical miners, who had but one miner and one carpenter to direct for making a shaft, begun on a diameter of 11 feet and completed at 8 feet; then carrying a drift-way 5 feet in height, wherein not a single brick had been used.

Well may it be said, in respect to these great efforts towards making "convenient carriage-ways" *quite water-proof*,

"*Parturiens mons, nascitur ridiculus mus!*"

And now not a vestige can be traced of these vast labours.

But of the Thames Tunnel there is to be seen that which demonstrates the practicability of the plan of Mr. Brunel; and knowing that it has withstood the shock of two irruptions of the river, we have a sufficient security of the strength of the structure to assure us, that when completed it will endure—a lasting monument to national enterprise and zeal in promoting practical science. We may at this period repeat what his Grace the Duke of Wellington said of it in 1829, viz. "There is no work upon which the public interest of foreign nations has been more excited than it has been upon this tunnel;" and for a confirmation of the interest felt in our own country we may refer your readers to the transactions in the House of Lords on the 2d of July, 1830, or of the House of Commons on the 24th of August last.

The reports of the former attempts and proceedings were published in 1809 by the Directors of the Company, when they made a public appeal for plans, offering a liberal reward for that which should be adopted. Fifty-three plans were obtained upon this appeal. The practical and scientific men, to whom they were referred for examination, concurred in opinion that none would answer for effecting the object on a proper scale. All farther attempt was in consequence given up by the Company. A subsequent one, by working from above the river, proved equally unsuccessful.

Had your correspondent, Mr. Editor, in No. 605, been as solicitous for correctness as he is familiar with censure, he would not have felt himself called on to reprobate the Lords of the Treasury for having granted 250,000*l*. for the completion of an enterprise, so far completed as it is, which had received the fullest and most unequivocal approbation of his Grace the Duke of Wellington; no mean authority in such matters, more particularly when he had made himself familiar with those facts and circumstances already stated, but which is attempted to be denied by your correspondent. Nor is it other than natural that the late First Lord of the Treasury, Lord Althorp, should have been influenced in his decision by such sentiments as those publicly expressed by his Grace; as, for instance, "*that the novelty of the work, the difficulty of ascertaining the nature of the bed of the river, and the accidents to which such a work was liable, tended to increase the expense of this great undertaking, yet that the work itself had cost only* 120,000*l.*;" that is, at the period alluded to by his Grace, viz. the 11th of June, 1828, which included, however, the expense of the first eruption and part of that of the second. But up to the 31st of December, 1828, when the works were entirely suspended and were closed, the cost of the works of the tunnel, including the shield, the steam-engine, and a powerful pumping-apparatus, was not more than 126,740*l.*, including both accidents, instead of 240,000*l.*, as your correspondent asserts it. Adverting farther to the benefit which will result from the work by *uniting populous districts*, his Grace added, that "*men cannot but see the great political, military, and commercial benefits that will be derived from the example of such a work, in this and in other countries; that the accidents which have occurred have demonstrated the practicability of the enterprise, and the genius and the ability of the engineer who has conducted it; they have also proved this, that the work of itself is excellent, &c.*"

This same correspondent remarks, that if the engineer had gone deeper with his tunnel, he would have avoided all difficulties and accidents. Now were he to refer to the reports of those engineers already alluded to, who operated between the years 1803 and 1808, he would find that they could not venture lower than 76 feet—which fact he will find to be confirmed by well-sinkers, who have opened wells near the river on the south side; and further, he may be informed, that eminent geologists have warned Mr. Brunel of the probable effects of the 50 feet bed of blowing sand existing below that depth, and that they recommended him to keep as near as possible to the river as, perhaps, the enemy least to be dreaded.

Notwithstanding the public acknowledgment by the Duke of Wellington of the utility of the undertaking, and of the national honour which is attached to its completion, and notwithstanding the confidence which even the most disastrous accidents have inspired in the plan, by which one half, or nearly, of the undertaking has been realised and carried to the deepest part of the river, another correspondent or contributor of yours in No. 626, subscribing himself *Fanqui*, excited evidently by some grievous disappointment, protests against the enterprise, premising with an eulogical preface on the present member for Berkshire for *his manly exposure* in the House of Commons, of the pretended *manœuvres of the patrons of the Thames Tunnel in obtaining 270,000l. from the Government.* This critic unhesitatingly affirms, that the work, "*if ever finished, will only be a monument of folly and absurdity, because no vehicles of any description will ever use it as a means of transit.*" And he concludes by asking, "*who were the three most eminent engineers who had examined the plans of that scientific engineer, Mr. Brunel?*"

The charge of folly and stupidity certainly possesses some novelty to those who have been taught to value the benefit of good communications across a large navigable river, as the Thames is all the way from London Bridge to its mouth, where a permanent land communication cannot possibly be obtained. But to his question. It may be replied, that the Duke of Wellington was the first eminent engineer who, as far back as the year 1820, had examined the plan, and who from that time to the present has continued to manifest great interest in its application. The late Dr. Wollaston may be considered the second who expressed himself most favourable to the plan, and, it may be added, that the name of Wollaston stands the first in the enterprise, and most prominent, not only in the list of subscribers, but of proprietors to this day. In Mr. Donkin may be found the third, a gentleman who, from his practical knowledge of machinery, was fully competent to judge as to the efficiency of the shield after he had examined it.

I cannot but give a specific denial to the assertion, that the speculation was one of those which take their date from the eventful years of 1825 and 1826, because the first meeting, convened by the friends of the enterprise for organising a company, took place in December, 1823, and the subscriptions were made up at a General Meeting in February, 1824. Should your correspondent not be satisfied with the testimonies already adduced, we may refer him to a leading article in the *Times*, at that period conducted by the present member for Berkshire. The article in question is dated 4th July, 1828; consequently, after the two eruptions of the river. It is therein said, that "*the Thames Tunnel is an undertaking of the highest national importance and credit, and such as ought to meet with the most ample public support in extricating it from its difficulties, and rendering it a proud monument of national utility and honour.*"

We may conclude, by informing your numerous readers and the public, that this national undertaking is in progress towards that anticipated achievement; and we may, on the best authority, add, that the front of the excavation has been worked and advanced several feet, and the ceiling of it raised in equal proportion; the whole having been done with perfect safety; and, moreover, that a considerable part of the old shield has been removed, and some portion of the new one has been put up.

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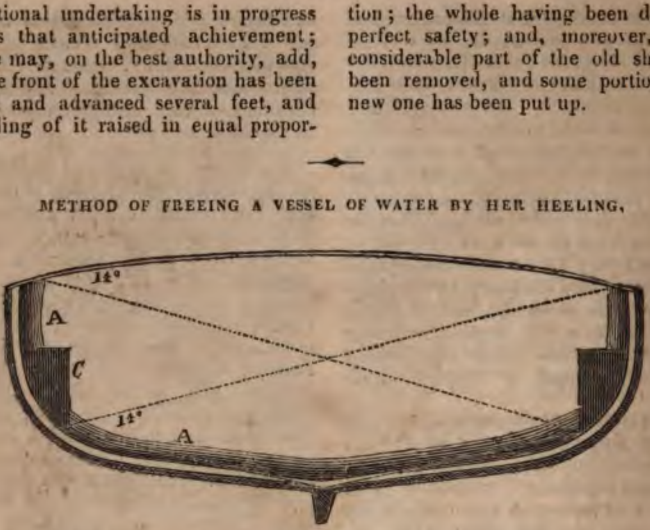
METHOD OF FREEING A VESSEL OF WATER BY HER HEELING,



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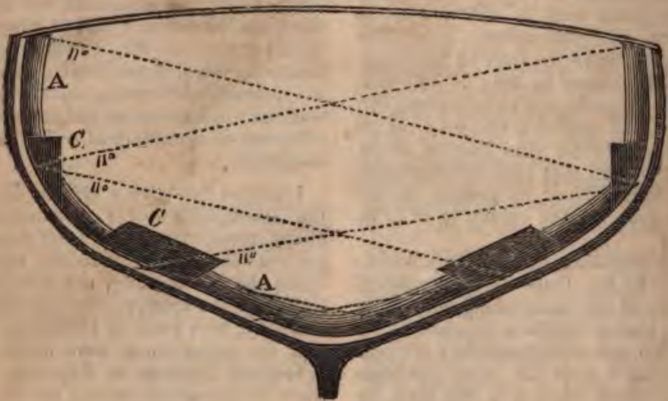


Mr. Editor,—On the supposition that if a plan, however simple, contains usefulness enough in it to make it but once successfully applied, it is worthy of publicity, I beg your insertion of the following:—

There is nothing novel in taking advantage of the pitching or rolling motion of a vessel, or of that derived from her way through the water, for the production of a power to work pumps; with that view, various modes have been suggested and patented; but I have never heard of any plan to make available the steady heeling of a vessel in smooth water. Now, having been in a situation at sea where the following simple method of freeing a ship from water by her heeling merely, would have been most desirable, had I not been otherwise relieved, I the more freely offer it to the public.

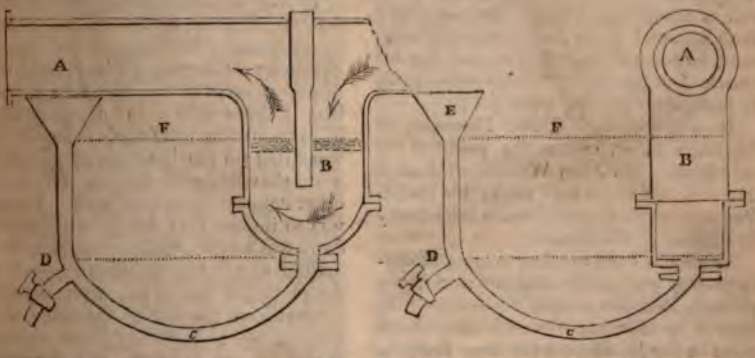
The midship section of the vessel, to which I allude, was about the form of fig. 1. She had sprung a leak, and in heeling I frequently saw the water in the lee bilge as high as the deck; when it occurred to me, that if that body of water were withheld in a water-tight case, it would, when the vessel was on the other tack, be emptied on the lee-side, giving her, at the same time, the advantage of greater stability, whilst the weight of water preponderated to windward; thus, at least, making up for the loss of stability she would otherwise have sustained by a constant weight of water to leeward.

In a flat vessel, like that of fig. 1, one of these cases, C C, on each side, would suffice, as they would empty themselves when the vessel's heel exceeded 14°; but in a deep vessel, as in fig. 2, two of these cases on each side would be required; the water would then be emptied when the vessel's heel exceeded 11°, whether by the conduit-pipes, A A A A, or by those represented in both figures by the dotted lines; which ever of the two modes should be considered the most convenient for adoption at the moment.

This plan is by no means proposed for general adoption, as the cases which should be very long to contain much water, would take up some valuable room in the vessel, but only as a make-shift plan in such a case as a vessel's making more water than her crew could conveniently clear her off, without their being able to discover and stop the leak; and, as in my case, obliged to make good a point to windward, though able to procure materials (slight deals would do) to make the cases and conduit-pipes or troughs. The latter may enter the cases either below with valves or above without them. The plan, in my opinion, is most adaptable to river barges, which are constantly tacking in blowing weather, and are often leaky. It would also be worth while considering, whether the plan might not be usefully applied to channel buoys to clear them of any leakage, as being a species of pump least likely to get out of order by time or usage than any other. Having, I trust, given sufficient explanation of my ideas for comprehension,

I remain, Mr. Editor,
Your obedient servant,
⊕.

WATER GAS-VALVE.



Sir,—Having read a description of a patent gas-valve by Mr. Carter, in your Magazine of last month, I have been induced to send you a sketch of a water-valve that has been several years in use here, both at Marshall and Co.'s works and at the Salop Gas-works. This valve possesses cheapness and durability, and is, in my opinion, superior to any other I have seen.

Fig. 1 is a *longitudinal, and fig. 2 a cross section of this valve; A, a four-inch gas-pipe; in the middle of which is* a cast-iron water-valve, B, attached to the main-pipe by bolts and nuts; at the bottom of the valve a small pipe, C, of either copper or lead, with a cock at D, is connected with the bottom of the valve. To shut off the gas, the cock, D, is closed, and two or three quarts of water are poured into the funnel, E, at the end of the small pipe; when the water reaches the dotted line, F, the gas is prevented from passing through the valve.

In order to open the valve, the cock, D, is opened, which lets the water out of the valve as low as the level of the cock; and so long as the cock remains open, the valve becomes a water-trap, and lets out at D any water that may have got into the main-pipes. At the same time, the gas is prevented from escaping, by the water in the small pipe being below the level of the cock.

The above-mentioned valves were made by Mr. John Onions, of Broseley.

I am, Sir,
Your most obedient servant,
Peter Horsman,
Secretary Mechanics' Institution.
Shrewsbury, Oct. 3, 1835.

IMPROVEMENTS IN STREET-PAVING.

Mr. Editor,—Who first hit upon laying serrated carriage-way pavement is not exactly known. It is said to have been laid in Paris, in some of the towns in Normandy, in Ramsgate, Bristol, and Liverpool, before it was tried in London.

Its advantages are, the affording better foot-hold to horses in ascending, and giving them confidence in descending, hilly grounds. Its disadvantages may be, the more rapid wear of the stones, and the consequent additional expenditure; the risk of horses stumbling as they descend; the chance of every joint, in frosty weather, forming a ledge of ice; and the insecure footing which its asperity causes to foot-passengers in crossing.

It is reported that Mr. Freeman, of Millbank-street, claims the credit of its invention. Mr. John Watson, of Ramsgate, is understood to prefer his claim. Perhaps our lively neighbours may really be entitled to the honour.

There has been another sample of carriage-way pavement, adapted for rising ground, laid down upon Fish-street-hill, formed by inserting narrow slips of York stone in the joints, so as to keep the granites about an inch and a half apart. In this mode the angles of the pitchers are more protected, and they may wear longer.

Time and observation will show which is best adapted for public use.

I am, Mr. Editor,
Your very obedient servant,
Q.
Oct. 13, 1835.

Sir,—I do not intend to enter into a controversy relative to the utility of the new method of street-paving on inclinations; the public will soon find out whether it is or is not both useful and beneficial. The object of my addressing you is merely to state, that I am the inventor of the method, and forwarded it to Mr. Richard Lambert Jones (by the hands of the Deputy-Chairman of these works, Sir William Curtis, who obligingly undertook to put the plan into his hands), for the purpose of being used in those places in the city of London which might require it. Mr. Jones then introduced it to the notice of the Commissioners of Sewers, who have tried it with success on Fish-street-hill and on Snow-hill; and I hesitate not to assert, that it will be found equally so on Holborn-hill. Therefore, the *fears* of some of your correspondents will not be realised.

I am, Sir, your obedient servant,
John Watson,
Superintendent of the Works.
Royal Harbour of Ramsgate,
Oct. 20, 1835.

ON FIRE-PROOF BUILDINGS. BY MR. CHRISTOPHER DAVY, ARCHITECT.

(In continuation from p. 23.)

Lord Stanhope's Experiments.

In the communication that preceded my last, mention is made of two extensive experimental buildings erected by Lord Stanhope at Chevening-place, Kent. One building secured according to the plan that I have given in detail (namely, by extra lathing and double intersecuring), was filled (in the lower part) completely with shavings and faggots, mixed with other combustibles, and fired. The heat was so intense that the glass of the windows was melted, "like so much common sealing-wax," yet the flooring-boards of the room (16 feet × 26) were not burnt through, nor was one of the side timbers, flooring-joists, or ceiling-joists, damaged in the smallest degree, and the persons who went into the room immediately over the one filled with fire, did not perceive any ill effects from it whatever; even the floor of the room being perfectly cool during the enormous conflagration immediately beneath. The unsecured building was, with the mass of combustibles that it contained, set on fire after the first experiment. The height of the flame was no less than between 80 and 90 feet from the ground, and the grass upon a bank 150 feet from the fire was entirely scorched, yet the secured wooden building quite contiguous to this vast heap of fire was not at all damaged, except some parts of the outer coat of plaster-work. His Lordship observes:—"This experiment was intended to represent a wooden town on fire; and to show how effectually, even a wooden building, if secured according to my method, would stop the progress of the flames on that side, without any assistance from fire-engines, &c." On the same occasion the experiment was made of attempting to burn a wooden staircase, secured according to the simple method of underflooring. The under side of the staircase was "*extra lathed*;" several very large kiln-faggots were laid and kindled under the staircase, but it resisted, as if it had been fire-stone, all the attempts that were made to consume it.

Lord Stanhope continued to prosecute his inquiries for a considerable period after the results of these experiments became known; and eventually the Association (before alluded to) determined to give his plan a trial. A house (No. 5, Hans-town) was secured by plaster, according to the directions given by Lord Stanhope, in his paper read to the Royal Society. The composition used was similar to that before described; the experiments took place as follows:—

August 2, 1792.—At forty minutes after two-o'clock, a fierce fire was lighted on the flooring-boards, and against the ashlering in the front-garret, which had been secured and finished as usual for habitation; the fire was kept up by a continual accumulation of fuel till forty minutes after three o'clock, when it was extinguished. At this time the skirting-board was burnt through, as far as the fire or fuel was in contact with it, but no farther; the flooring-boards for the same extent were charred nearly through, and one piece of quarter in the ashlering was charred; but there was no appearance which could give the Committee reason to suppose the fire would have spread had it not been extinguished. At the same time a fierce fire was lighted on the floor in the back-garret, and against the ashlering (both of which had been secured, and the room completely finished for habitation), and kept burning for the same length of time. The effect of this was nearly the same with that of the before-mentioned and *contemporary* fire. In the seat *of the fire, which* was kept up very strong by additional fuel, the flooring-boards were charred considerably. The plastering of the room gave way; the skirting-board being burnt, the quarters of the ashlering were exposed and damaged; but there was no reason to consider that the fire would have spread had it been permitted to continue of itself. It should be observed, that in the case of these two experiments, the ceilings immediately under were not laid.

On the same day an experiment was made on the staircase, which was secured with plaster following the steps and risers, and the stairs were finished for use. The string underneath was not laid. A fierce fire was lighted at ten minutes to four o'clock, and kept up till twenty minutes past four o'clock; this fire covered the whole of the first flight up to the garret. Upon extinguishing the fire, it appeared that the risers and treads were considerably charred in the seat of the fire; but there was no reason to suppose that the fire would have spread to any material extent had it not been put out. The plaster remained uninjured.

October 4, 1792.—An experiment was made in the back-room, which was secured with plaster, and finished. A fierce fire was made on the floor, and against the partition which separates this from the adjoining room, and kept up for the space of one hour and three quarters, during which time fresh fuel was continually added. The ceiling underneath was not laid. At the expiration of half an hour no damage appeared; but at the end of the hour and three quarters the fire made its way through the floor, and consumed part of the joists immediately under it, three of the quarters were much charred, the plastering of the partition gave way, and, the quarters behind being exposed, the fire was seen extending itself up them. In this experiment, however, as in the others, it did not appear probable that the fire, if left to itself, would have spread so far as to be of any consequence.

December 26, 1792.—An excellent and convincing experiment was made in the one-pair back-room. The room was completely finished for habitation, the ceiling of the room underneath was finished, which had not been the case in any former experiment, and which, as it admits air to the underside of the fire, was conceived a disadvantage. The partition between the room was intersecured, and also the floor and ceiling. At half-past twelve o'clock, a large, strong charcoal fire was made on the flooring-boards, clear of the sides of the room, and continued till *four* o'clock. A large additional wood fire was made in the angle of the room next the partition. And both fires were kept up by a constant accumulation of fuel, so as to render them exceedingly fierce. In the seat of the charcoal fire the flooring-boards were burnt through, and two of the joists damaged two inches deep. With respect to the angle fire, that part of the floor and skirting which was immediately contiguous to it was much damaged, two of the quarters were charred fifteen inches up, the plate of the partition and the bond timber was slightly charred.

Another experiment was made to resist the strongest fire in the back-parlour, which was doubly secured for the purpose; the floor, sides, and ceiling, with plaster, the door and window-shutter with Mr. Hartley's fire-plates. At a quarter to twelve o'clock a fierce fire was made with a tar-barrel, pitch-boards, and other combustible matter, so as to occupy the whole room, in a manner something similar to that described by Lord Stanhope, in his paper read to the Royal Society. Fresh fuel was continually added, and the fire remained in the same state till one o'clock, at which time the shutter was closed. By this the fire was choked, but continued to smoulder on till half an hour after two; when it appeared that the flooring-boards were charred considerably, the ceiling and plastering had given way, the joists and timbers which became exposed thereby were charred, but the rooms adjoining, and the wooden staircase, which were separated only by wooden partitions, were not at all affected during the whole experiment.

C. Davy.

3, Furnival's Inn, Oct. 13, 1835.

(To be continued.)

NOTES OF A TRAVELLER ON AMERICAN STEAM-NAVIGATION.

NO. II.

Mr. Editor,—If any accident occurs to a Western steamer, the captain at once takes the active command on himself. Accidents are very numerous, so much so, that the risks are considered much greater in going 1000 miles on any of the Western rivers, than the same distance on the high seas. These dangers may be classed according to their frequency and danger; they differ in the up and down voyage.

The total loss of the vessel may arise from being "snagged" on the return voyage. Captain Hall and others have explained the circumstances which cause this accident; but as some of your readers may have not seen his work, I may state, that it is found by the stems of trees entering the bottoms of the vessels, whose roots, loaded with clay, &c. are touching the bottom. The stems, being light, float, while the roots drag along the bottom, or are fixed by being interlocked amongst sunken logs. The tops of these stems sometimes remain permanently above the water, but generally the current forces them up and down, so that the pilot cannot perceive the log when it is under the surface, and steers the boat to certain destruction. These logs, whose ends rise above and fall below the surface of the water, are called "sawyers," from their movement resembling a man at work over a saw-pit. Their ends are generally pointed. There appears to be no way of guarding against accidents from this cause, for the sawyers generally take the steamer about midships, in the very centre of the hold, a little further aft. The reason is evident; if its end is so near the surface that it would strike the bows in its ascent, the pilot would see it, or the ripple in the water which would precede it; now, as the boat sinks a certain distance, its bottom advances so far towards the ascending log, which has been constantly rising, and again the water moved forward by the boat itself, has had the effect of accelerating the rise of the log, so that it most frequently takes the steamer a little abaft the beam. If the log should not rise and strike the bottom until near the stern, the shape, or inclination, or "run," of that part is generally sufficient to prevent its entering. Cases, however, have occurred of vessels being snagged very far aft. The snag chamber is generally looked on as a preventive to such accidents, but it is not the slightest protection against the attacks of sawyers. It may be of great use in the case of accidents arising from the bows being stove in by collision with other boats, firm logs, rocks, and so forth; but if the steamer is carefully steered, no accidents of this kind can occur. On the downward voyage, it is the custom to load the boat to the water's-edge, if freight can be obtained; so that if the snag chamber were broken into and the water let in, the vessel would sink, though not a drop of water might get into her proper hold. Accidents, from logs, are rather rare in the downward voyages. It is not uncommon for steamers to come in contact, for this reason: in going down, the rule is to keep the very centre of the river, the current being there generally strongest and most favourable; a boat coming up, therefore, avoids the centre as much as possible, and endeavours to keep in the eddy: this obliges the pilot to run her across the main current at every turn of the river; and as some of these turns are very acute, and the trees grow to the water's-edge, neither pilot has any intimation of the presence of the other until the boats are in contact. The only remedy for this, would be to clear the timber from the points or capes which now obstruct the view. In the day time, the steam can be seen rising over the trees; but experience shows this to be insufficient, for steamers often come in contact even in the day-time. The pilots excuse themselves by saying the current deceived them; and if we consider the subject in all its bearings, we must admit the possibility of the currents being always different, not only at different points, but actually at the same point; for the shape of the point is constantly changing, and the water is constantly rising or falling. The Mississippi is more properly a flood, than a river at the season it is mostly navigated. I say it is a flood, because our notion of a river involves a presumption of the water being held in check by banks, which rise more or less above the level of the water: thus we have the Severn, the Clyde, and the Shannon, strictly and properly called rivers. But if the surface of one of these were to rise, so that the water would overflow the country for many miles on both sides, so that we could not see the extent of the inundation, we would, very properly, call it a flood. Such is the general character of the Mississippi at high-water in spring; indeed, words can give no idea of the vast quantity of water which runs over its banks into the boundless levels which occupy its shores, and which never returns to the river. This water evaporates, is absorbed by the ground, or discharged into the sea, by many outlets, some of which are equal to large rivers. A great quantity of it remains in stagnant swamps, which poison the atmosphere on the return of warm weather.

The changes in the bed of the river, produced by the annual flood, are incalculable; the pilots notice them, and tell each other, so that they become a body of men, bound together by a common interest.

Great allowances are to be made for accidents arising from collision of boats, though it cannot be denied that much neglect has existed in some cases, and that wilful malice has even led pilots to run against boats, and sink and injure different craft.

The pilots were endeavouring to form a union amongst themselves, to regulate the number of apprentices and so forth. If the captain and owners have not set their faces against this measure, it is apprehended that in a short time the jealousy of "the body men" will lead them to injure all vessels not steered by one of the craft. The body will become indifferent to the duty, which, as individuals, they will be obliged to perform, and the public will be injured proportionably. At present, any man acquainted with the rivers may pilot, and be employed by any person. When these rules are established, the competition will be entirely destroyed. Then we shall see the same species of puppyism established on the Western waters, which is now so much complained of in the New York dandy pilots, who have become so nice, that they will not venture out to sea except when there is no occasion for them (as pilots); for they must not only take care of their precious and beautiful boats, but of their not less beautiful and elegant selves, wives, and so forth.

The Western steamers are frequently burned, particularly when they are loaded with cotton: many such cases have occurred when they were lying in port. Most of the latter have been attributed to incendiarism, and with, I fear, too much truth: though neglect of the lamps near the engine, or fire in the cooking-stove, may have been the cause of some. The rapidity with which the fire seizes on the light framing and sheathing, which compose the cabins and roofing, is truly astonishing; in a few seconds, the whole body of the vessel, above water, presents one body of flame. There appears to be no chance of a person escaping, though the cabins have plenty of doors, for generally the majority of the people, in bed at the time, are destroyed. The spread of the fire may be attributed to the combustible nature of the white pine, the material used in the construction of the cabins and the tarred roof, and the perfect draft which is established through the doors and windows in all directions.

Several steamers have been set on fire by spontaneous combustion, produced by acids being spilled amongst the cargo, from packages of drugs. Gunpowder has also been shipped as common freight, and fired by accident. It is customary to have a powder-room in the steamers, into which this substance should be always stowed; but as the freight for powder is rather higher than for other commodities, the villanous merchants put the casks into boxes, and label them "glass," with "this side up," and so forth, to deceive the clerk of the boat, and save the slight difference in freight. This is one of the thousand instances of recklessness which the traveller sees every day in the United States.

Running aground, is a very common accident, particularly when the rivers are very high or very low. In the first case, the pilots venture to run through short cuts, to avoid long bends of the rivers, or in very high water, over tongues of land, which have been cleared of timber. In the second case, the pilot cannot know of the creation of new bars and banks on the moving of old ones, which is constantly going on. It is very interesting to examine the beds and banks of these rivers after every flood, to observe the great changes. In the lowest water, there is a constant motion of the surface gravel of the rapids. If the water is clear, the stones appear to float down the stream. The channel narrows and deepens over the bars, so that a steamer may pass over a rapid to-day, which could not have done so yesterday, though the water is actually the same; and if we judged by the bank, we would imagine it to be less, its level being lower. The Americans exhibit their peculiar cunning and daring, in meeting with, and overcoming, all the difficulties they have to encounter on these occasions. If the rapid is too shallow, and the ground hard, the boat must be lightened; for this purpose the passengers are sent ashore: if this will not do, a portion of the cargo is shifted into another boat, or landed; and if all this is not sufficient, a rope is made fast to an anchor right ahead, and brought round the main shaft, when all hands get into the water, and push and lift the boat, the engine being "set on." The anchor must come home, the rope slip or break, or the boat move, which generally happens. In some cases I have thought it would have been much safer and easier to make a dam abaft the vessel across the rapid, than to strain her by the purchase. A dam composed of stakes, with a canvas cloth stretched from one side to the other, with branches and dirt in front, would be often sufficient to raise the water a foot or 18 inches, which would be quite sufficient. The stakes could be removed and brought forward to the next stop, and so on until the rapid was got over. Thus we should have a portable lock established. I have tried this on a small scale, and think it will answer when the ground will hold stakes, and the sand is running. At first, one would think that it would be better to deepen the channel, but this would increase the current, and lower the water above; so that instead of having one shallow to overcome, great numbers might be created, and the whole navigation stopped by cutting thus a single bar, which might "back" the water for many miles.

There is a practice universal on the Western waters of "rounding to," or bringing a steamer's head up stream, whenever it is necessary to stop her for a few minutes. I confess my ignorance of the use of this practice. It takes up time, and is certainly attended with danger of running ashore, &c. As the paddles can be reversed in their movement, and as the boats generally steer very well, I see no utility in this practice, which I think is found fault with by Captain Hall. It is adopted by some very able sea captains who have the command of steamers, as well as the old stagers. One would be led to attribute the *practice* to the era, when engines were so rudely constructed, that they could not be made to reverse their movements, or back water. Neither pilots or captains defend the practice or explain it.

When a steamer runs aground on the bank, the usual mode adopted for moving her, is to run out a boom in a sloping direction from the steamer's bow. The butt of the boom is firmly set in the bank; its other end extends some distance above and over the deck of the vessel; and a bolt or *ring* is fixed in the gunwale immediately under the boom. The upper end of the boon is then rigged with a system of pulleys, one end of which is attached to the ring. The fall is then passed to the capstan, or all hands are called. On the word being passed, a strain is given, which has the double effect of lifting the vessel and pushing her off the bank at the same time. The process is generally effective. When it is not, and the water is falling, the vessel remains fast until the next rise of water; or if there is no chance of that, the same arrangements are made for launching her, as if she were going for the first time into the water. I saw the Brandywine (650 tons) launched in this way, after she had been left high and dry on a bank.

Finally, steamers are frequently much injured by the branches of trees projecting from the sides of the banks, or hanging into the water, when they are going up stream. I might enumerate other causes of accidents, but as they are common to *craft* of all kinds, I shall pass them over in silence. The wind has much power on the Western steamers, from the great height and extent of their roofing and balconies. Several have had narrow escapes of being upset from this cause, but I do not recollect any serious accident having occurred from it.

I have been rather particular in pointing out these peculiarities of fresh water or river navigation, for I wish that the subject should be well considered before any more attempts are made to navigate the African or Asiatic rivers. In common with many friends to the improvement of the tribes which inhabit *central* Africa, I *regret the failure of the steam* speculation on the Quorra, though I do not see how it could have succeeded. To make sure of the trade of that river, I think the quondam slave-merchants of Liverpool might readily enter into arrangements with their old correspondents, King Tom, &c. &c., at the mouths of that river, and agree with them to enter into the more profitable business of carrying goods up and down, and slaves also when opportunity offered. But though I would permit the slaves to be sent down the river, I would also advise our government to prevent the slaves being shipped, or if shipped, to make sure of capture: the trade would be then put an end to, and the traffic, if continued, confined to the continent itself. Looking on the subject merely as a money-making scheme, I do not see why Liverpool merchants, who have connexions on the Quorra, should not propose to them to join them in the speculation, on such terms as would be profitable to all parties. No doubt we should soon see the same metamorphosis in the Bight of Benin, of slave dealers into philanthropists, that we now perceive in Liverpool, when it would be their interest to turn or change. The mere difference of colour is quite immaterial. The black man is as vain, and as much alive to his interest as the white. Make it his interest to be honest, just, and honourable, and he will be so, just as much, if not more so than the white. Indeed, if the blacks at the mouths of the Quorra were not, like "honest thieves," true to each other, they would be unable to prevent or regulate the oil and slave trade in that quarter. The climate is a great objection to the navigation of that river; but it so closely resembles the Mississippi and its tributaries, that I think the officers should be selected from individuals who have long been accustomed to the climate of the Mississippi and Lousiana, the West Indies generally, and the Mexican mainland. These parties would be seasoned to "*the vegetable*" atmosphere, or miasma, which always abounds in flooded districts. They would also be accustomed to the heat, which is so distressing to Europeans, and also able to understand and overcome all the ordinary difficulties of river navigation.

Our merchants, generally, are interested in opening this trade, which offers incredible advantages in a pecuniary point of view when once established. The philanthropist and Christian are interested in having the lights of civilisation and religion carried into the centre of that vast continent. The mere philosopher is desirous of knowing its productions, and all men are now interested in extending the markets for home industry — in obtaining new raw materials for manufacture, or the old at lower prices. It has been proved that cotton, rice, indigo, &c., could be procured from that river in great quantities in a few years, if the trade were once established.

If the Tobins of Liverpool, the Barings of London, and a few more individuals who have connexions both in Bonny and New Orleans, would set to work properly, I have no doubt that the navigation of the Quorra could be established in a few years, in a permanent and profitable system, on similar plan and principles to that of the Mississippi.

The navigation of the Indies, Ganges, &c. in India, should, I think, be conducted by experienced persons from the Western rivers, and in boats of similar construction. The navigation and its dangers and difficulties, are the same in all; for all these rivers are subject to the same rises and falls.

In my next, I will give you some account of the construction and arrangement of the boats alluded to in this paper.

Truly yours,
E. Talebois.

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COOKING BY GAS—REPLY OF MR. T. G. BARLOW TO MR. BEALE.

Sir, — If your correspondent, Mr. Beale, whose letter on Mr. Hicks's patent gas-cooking apparatus, in a late number of your periodical, has attracted my attention, will be kind enough to peruse a few observations I have to make on that communication, I think he will retract some of the harsh language, which, without sufficient inquiry, he has indulged in; or if he still persist in all he has asserted, I must leave it to your readers to decide against whom his charge of "unjust and unmanly" conduct, may most truly be brought. Allow me, however, to premise, that I should not have taken upon myself to *notice* this communication, had not Mr. *John Barlow, against whom is* directed much of its abuse, been in the country, and many of its misrepresentations requiring in the opinion of his friends a prompt denial.

With what propriety the courtly epithets of "unfair dealer, impostor, marauder," and such *Whitechapel* slang, are applied to a humble individual, who unostentatiously, and without arrogating to himself any claims, either as an inventor or improver, endeavours to bring into practical operation a novel process; and without the remotest prospect of personal gain, but actuated solely by a desire to increase the public convenience, I leave your candid readers to determine. Mr. Beale, himself, seems already to have been assured, and I can confirm the impression, that neither directly nor indirectly has Mr. J. Barlow any interest whatever on the sale or manufacture of any gas-cooking apparatus, except, indeed, that of being generally interested in the success of gas-works, on which ground, I presume, Mr. Beale does not seek to ground his quarrel. Mr Beale appears, however, to have incurred his displeasure, by having, in a private communication to a friend in New York, drawn his attention to this novel process, without naming Mr. Hicks as the inventor and patentee; this surely can be no great crime, for the defects of Hicks apparatus must be apparent to any one who has witnessed its practical, not experimental, operation; and if any one has reason to complain, I think it is Mr. Sharp and Mr. Ricketts, for so far as I can judge, they are the only persons who have really constructed an effective and economical apparatus. Mr. J. Barlow's object, however, was not to recommend this or the other machine; it was solely to draw his friend's attention to the process, leaving him, and the ingenious citizens of the United States, to devise the means of effecting it. I need scarcely add, that the insertion in the New York American was made without his sanction or knowledge.

My own business had called me to visit that country in the early part of that year, and I was repeatedly solicited by many of my hospitable friends in New York, to construct some rough apparatus sufficient to convince them that meat might really be roasted by a gas-flame, without communicating any disagreeable flavour. I promised compliance, and as the cheapest and least troublesome for a mere experiment, I made use of a metallic cone. The description quoted, in No. 631 of your Magazine, from the New York American (of which, by-the-bye, Mr. Beale, in his jealous protest, accuses me of being the author), is, on the whole, tolerably correct, though in several particulars erroneous. I never saw it till it was pointed out to me in your periodical, or I should have taken steps to set my friend, Mr. King, the editor, right upon a few points. So far as I am connected with the dispute, I can assure Mr. Beale that I have never claimed any of the merit of the invention; my object was accomplished in having gratified the curiosity of some of the kindest friends I was ever amongst and set their ingenuity at work in improving the rough idea I had given them. With respect to Mr. Hicks, allow me to inform Mr. Beale, that while in the United States, and especially while on a visit to Boston, I made repeated inquiries with the view of obtaining his address, and calling upon him. I had been given to understand that in consequence of pecuniary difficulties, he had gone to America (or was, in fact, as his friend states, "out of town"), and had located himself near Boston, intending to pursue his profession. My inquiries failed in their object; and the hope I had indulged of being able to put Mr. Hicks in communication with parties, where his talents might have met with encouragement, was frustrated.

But, to return to Mr. Beale's letter, it appears to me, that the only positive and tangible accusation is, that the gas-cooking apparatus in Mr. J. Barlow's house, though manufactured by Mr. J. Sharp, of Northampton, bears the name of another maker in London; so that, in fact, to avoid detection, recourse has been had to a most disreputable deception. Grave charges, made on weak grounds, are dangerous weapons to use, be your antagonist ever so guilty; for, if they fail in being established, or their fallacy detected, the blow intended for the accused recoils with fatal violence on the accuser. The fact is, that, in the kitchen to which Mr. Beale's spy obtained admission, there *are two gas-cooking apparatus; one a roaster*, bearing the inscription on a brass plate, "Sharp's Improved," made by, and purchased of, Mr. James Sharp, of Northampton; the other is a steam-generator, bearing on a brass plate, the name and address quoted by Mr. Beale, "Josse, Regent-street." This latter apparatus seems to have been originally constructed for use over an oil lamp; and was purchased some months since, together with four steaming-pans, of Mr. Burnes, broker, City-road, for the sum of 3*l*. Now, the truth seems to be, that Mr. Sharp's roaster differs so completely from Mr. Hicks's, that his agent's spy, a man sent with the express intention of procuring legal evidence, on which to ground an action for an infringement of his patent, passes it by unnoticed, although fixed within a few inches of the boiler, and selects an old lamp apparatus, which has been used for years, purchased at a broker's shop, on which he attempts to substantiate a charge, involving the moral character of several individuals, whose honour is as dear to them as is Mr. Beale's to himself. Really the mistake into which this trustworthy spy has fallen is so ludicrous, that I scarce know whether to deal with the charge seriously or in jest.

And now, as to the extent of the operation of Mr. Hicks's patent, which, perhaps, after all, is the only subject to which it was worth while to have alluded, I will, in a few words, state the result of the investigation I have made. Mr. Beale asserts boldly, "that any one making or selling apparatus for cooking by gas, with an ENVELOPE, must be infringing on Hicks's patent." This information startled me; and it was some time before I could believe that a man, with any character to lose, would deliberately and publicly make such an assertion. I have been at the expense of procuring an office copy of the specification and drawing enrolled under this patent, from which I quote as follows:—"Now, know ye, that, in compliance with the said proviso, I, the said Robert Hicks, do hereby declare the nature of my said invention to consist in adding to the ordinary culinary apparatus a range of gas flames, with a *conical hood* suspended over each, within which hood I dress meat, or other articles of food." Can Mr. Beale, or any other sophist, by any latitude of reasoning, prove this to embrace all cooking by gas "within an envelope?" The supposition is absurd; and I believe that Mr. Beale, knowing, as he must have done, the terms of the specification, has asserted a deliberate untruth. But Mr. Sharp uses no *conical hood*, no burner, such as Mr. Hicks describes; nor, indeed, am I aware of any other similarity between the two machines, than that gas is employed in both for the same purposes: an accordance which, I presume, Mr. Beale does not attack as an infringement of the patent.

Mr. Sharp has favoured me with a perusal of the correspondence which took place between himself, the patentee, and his deputy, at the time of his application for a license to manufacture Hicks's apparatus. Mr. Hicks required, in addition to a certain sum down, the payment of 2*s.* 6*d.* "*upon the sale of either burner or cone, by way of royalty*;" clearly indicating what the patentee considered as the legitimate extent of his patent. I suspect that, even had he "been in town," he could scarcely have "sanctioned, by his signature," Mr. Beale's arrogant assumption, that all cooking within an envelope was an infringement on his rights. It appears, however, by the correspondence, that Mr. Sharp had assented to Mr. Beale's terms, with one trifling exception, and his clerk promised his early reply, which, luckily for Mr. Sharp, was never received; and having, in the course of his experiments, demonstrated that a much more effective apparatus might be made without the aid of Mr. Hicks's "cone and burner," he saw no occasion to renew the application.

The whole matter thus resolves itself into a dispute between the inventors of two rival apparatus: let the public judge of their relative utility. If Mr. Beale, or any of his friends, his spy included, are anxious to satisfy themselves as to whether Mr. James Sharp is an infringer or not, he will be happy to see them at his house, at the Drapery, Northampton; where also, for the information of the unlearned in these matters, is deposited a copy of Hicks's specification and drawing, and the public may there be supplied with Mr. *Sharp's improved roaster* and boiler. Mr. Beale's threat of legal proceedings alarm no one; they are quite ready to be met whenever undertaken.

I am, &c.
THOMAS G. BARLOW.

32, Bucklersbury, London,
Oct. 17, 1835.

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THE SHIP-SINKING SYSTEM.

Kirkcaldy, Oct. 6, 1835.

Sir,—In your July Part I observe an article on "The Ship-Sinking System," referred to in the *Nautical Magazine* of last month. I shall be obliged, if you will do me the favour, to publish a letter or two on the subject, in order to verify and prove to be fact, what your correspondent, who is totally unknown to me, alleges. He says, "Much sinking of ships is indispensable to the driving of a brisk trade in sea-insurance; and, in order that Lloyd's may flourish, thousands of the best and bravest of our countrymen, and millions of property, are every year *systematically sacrificed*. We shall never, I am thoroughly convinced, have a safe merchant-ship in Great Britain as long as the worthies of Lloyd's can possibly prevent it. The insidious system of classification has been recently revised, and what is called a new system of registration adopted; but the new system is just as much in the shipwrecking interest as the old. The entire tendency of it is to take away all inducement from the shipowner to study strength of construction, by classifying ships according to their age, without any regard to their strength." Now, sir, I consider the above statement to be true to the very letter, and my reasons are as follows:—In September, 1834, I had it in contemplation to become part owner of a small vessel, to be built on the construction adopted in the Royal dock-yards, and the advantages of which, in point of safety, are exemplified in the cases of the Lightning and Flamer, Government steamers, published in your correspondent's letter. Before ordering the vessel to be built, I wrote to the Society for conducting Lloyd's Register of British and Foreign Shipping, to know whether any difference would be made in the classification of a vessel so built, and in the length of time she would be allowed to stand in the first class in the Register-book; and if so, what? The following is a copy of the answer I received, and which, that I may not alter the spirit of it, I give *verbatim*:—

"Lloyd's Register of British and Foreign
Shipping, London, 1st October, 1834,
White Lion-court, Cornhill.

"Sir,—Having laid your letter, dated the 26th of September, before the Committee of this Society, I am directed to inform you, that they beg to decline pledging themselves to any particular classification for ships which, by your description, will prove an exception to the general printed Rules they have adopted as the basis upon which they will in future be governed in the classing of ships.

"All persons are at liberty to construct vessels in any manner their own judgments or pursuits may direct;[*] and, if they think proper, to submit them to the inspection and examination of the surveyors to this Society, the Committee will then, to the best of their judgment, assign such character and term of years, *as a report of the materials used, and the description of the workmanship employed in their construction, in accordance with the principles set forth in the printed Rules, shall appear to justify*,[†] considering that they will then be in a more correct situation to do justice to the parties, than by now attempting to give a premature decision on that which is not yet in existence.[‡]

"I am also instructed to refer you to page 14 of the printed Rules, and remain, Sir, &c.

(Signed) "NATH. W. SYMONDS,
"Secretary,

"James Ballingall, Esq., Kirkcaldy."

On receipt of Mr. Symonds's letter, I wrote him again as follows:—

"Kirkcaldy, Oct. 8, 1834.

"Sir,—I am favoured with your letter of the 1st inst., and am sorry to find so little encouragement for improvement in ship-building, that the Committee of the Society of Lloyd's Register of British and Foreign Shipping beg to decline pledging themselves to any particular classification for ships, which would be an exception to the general printed Rules they have adopted as the basis upon which they will in future be governed in the classification of ships; because it not only does not hold out, but absolutely takes away, all inducement to construct ships of superior safety.

"Being, however, referred to p. 14 of the printed Rules, I observe that, 'The Rules herein set forth may at all times be altered by the presiding Committee, and especially to meet any acknowledged improvements which may be made in naval architecture, or in the materials used in ship-building.' Referring directly to this intimation, I beg leave, most respectfully, to ask, if the Committee are disposed to consider the merits or demerits of a plan for the improvement of naval architecture, and of consequence the condition of the commercial marine, should such be, as it is hereby offered to be, submitted to them unconditionally, and free of every expense whatever?[§]—I am, &c.

(Signed "JAMES BALLINGALL.

"N. W. Symonds, Esq."

To this letter I received the following reply:—

"Lloyd's Register of British and Foreign
Shipping, London, 15th October, 1834,
White Lion-court, Cornhill.

"Sir,—Having laid before the Committee of this Society your letter, dated the 8th inst., I am directed by them to refer you to my last letter of the 1st inst., and to inform you, they adhere to the determination therein expressed.[‖]—I am, Sir, &c.

Signed) "NATH. W. SYMONDS,
"Secretary.

"James Ballingall, Esq., Kirkcaldy."

To this letter I again replied as follows:—

"Kirkcaldy, 20th October, 1834.

"Sir,—Although I am perfectly sensible that all attempts to improve the structure of the commercial marine, through the means of the Society for conducting Lloyd's Register of British and Foreign Shipping, are visionary, yet being again referred by them to your letter of the 1st inst. on the subject, I beg leave to say there is one statement in it which I cannot allow to pass uncontradicted. It is stated (I quote the words), 'that they will then be in a more correct situation to do justice to the parties, than by now attempting to give a premature decision on that which is not yet in existence.' Now, I beg to say, that this is not correct. The plan I propose of solid bottoms and sides to vessels is in existence, and has been so in the Royal Navy for twenty-four years; and in every case, where it has been put to the proof, has been the means of saving the vessel; nor has it conduced less to durability than it has to safety. It is clear that the same means would produce the same effect, if adopted in merchant-ships. The plan is also in existence in the merchant steam-ship Royal Victoria, now building in Leith. I cannot look on the conduct of the Society in any other light than that of discouraging the building of strong, safe, and durable merchant-ships. —I am, Sir, &c.

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[*] The Society not having it in its power to control them.—J. B.

[†] I have put these words in italics, although they are not so in the original. It appears by them that a vessel will be classed in the Register-book only so far as she is built *in accordance with the principles set forth in the printed Rules*. This is directly taking away the inducement from , shipowner to build a safe ship, and it is evidently so intended.—J. B.

[‡] The superior method of construction adopted in the King's dock-yards is well known to the Society, as to all the world, to be "*in existence*." Besides, I submitted *models of the proposed construction to the Society at a former period, and, as individuals, they highly approved of them, though they would not say so as a Society*.—J. B.

[§] This question and proposal, it will be observed, was testing the sincerity of the Society in its proposal above set forth.—J. B.

[‖] It will be observed, this conveys no answer to my question.—J. B.

(Signed) " JAMES BALLINGALL.
" N. W. Symonds, Esq."

I received acknowledgment of receipt of this letter. I presume I need hardly add that, finding I was to derive no advantage from additional safe construction of the vessel proposed to be built, I declined ordering her, and I leave to your readers, whether I have not proved your correspondent's assertion, " that we never shall have a safe merchant-ship while the worthies at Lloyd's can prevent it," to be correct. I shall trouble you with one more letter on the subject,

And am, Mr. Editor,
Your most obedient servant,
JAMES BALLINGALL.

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ROYAL CORNWALL POLYTECHNIC SOCIETY.

THIRD ANNUAL EXHIBITION.

(Abridged from the *Falmouth Packet.*)

On the 29th and 30th of September last, the third exhibition of this Society was held at Falmouth. The attendance was numerous beyond precedent, showing that the Society daily grows in public favour. Mr. Davies Gilbert took the chair amidst loud applause, and briefly addressed the company. He was highly gratified to find that the institution had continued to excite an increasing interest. As a Cornishman, he felt the highest gratification in considering how high his native county stood in the scale of scientific research. It was with peculiar gratification he felt himself able to state, that the institutions of Cornwall stood high in the estimation of scientific men throughout Europe; and that at the late meeting of the British Association in Dublin, the consideration had considerable influence in the fixing on Bristol as the next place of meeting, that the members of the Geological and Polytechnic Societies of Cornwall might have greater facilities for attending. It would be unpardonable in him, were he to omit to notice how much the Society was indebted to the ladies, who had contributed in so considerable a degree, to render the exhibition both interesing and attractive The hon. gentleman next noticed those articles in the exhibition, which he considered to possess peculiar merit; after which he proceeded to deliver the prizes to the successful competitors, to each of whom he addressed a suitable compliment or an encouraging observation. The following is a list of the prizes:—

MECHANICAL AND SCIENTIFIC INVETONS.

Judges—Messrs. G. S. Borlase, J. S. Enys, R. W. Fox, W. J. Henwood, N. Harvey, W. Petherick, and W. Richards.

New Air Pump, Mr. T. Jordan, Penzance—First silver medal.

Detached Lever Striking Watch, Mr. H. Dobbs, Helston—Second silver medal.

Plan for Measuring the Length of the Stroke of a Steam-Engine, Mr. Phillips, Halsetown—First bronze medal.

Motion for Raising Miners, Mr. M. Loam, Consols—Second bronze medal.

Self-compensating Pendulum, Mr. Goffe, Falmouth—Prize, value 1*l*.

Portable Punching Press, Mr. R. Hosking, Perran Foundry—Prize, value 1*l*.

Improvement on Brass Burrs, Mr. John Arthur, Perran Foundry—Prize, value 15s.

New Wheel Wrench, Mr. M. Loam, Consols —Prize, value 10s. 6d.

Plan for Measuring the Stroke of the Engine, Mr. R. Hosking—Prize, value 10s.

Models of Machinery, &c.

Dialling Instrument and Quadrant, Mr. W. Wilton, St. Day—First bronze medal.

Two Models of Steam-Engines, W. Tresise, St. Just—Second prize, value 1*l*.

Model of Kitchen Range, R. H. Michell, Redruth—Prize, value 5s.

Naval Architecture.

Judges—Messrs. W. Broad and F. Symons.

Model of a Ship, J. S. Enys, Esq.—First bronze medal.

Model of a Corvette, Mr. R. Piper, H.M.S. *Astræa*—Second prize, value 1*l*.

(Then follows a list of prizes in the Fine Arts, (the most remarkable among which is one for a model of the Laocoon, in slate, by R. Burnard, of Fowey, a youth of 16 years of age,) and also in Natural History.

PREMIUMS.

The Premium of Ten Guineas, offered by J. S. Enys, Esq., for the best Plan for Measuring the exact number of Feet of the Acting Stroke of a Steam-Engine, was awarded to Mr. M. Loam, of the United Consols Mines.

The Premium of Ten Guineas, offered by J. Taylor, Esq., for the best Plan for Measuring the Supply of Water to the Boiler of a Steam-Engine, was awarded to Captain T. Richards, of Wheal Vor Mine.

The Premium of Ten Guineas, offered by John Buller, Esq., for the best Essay on the Natural History of the Pilchard, with a view to the Fisheries of the County, was awarded to Mr. J. Couche, of Polperro.

For the second best Essay, by Mr. H. Chester, Penzance, the Society awarded the first bronze medal.

The gentlemen to whom the two last essays were submitted, to consider whether the writers had fulfilled the conditions prescribed by Mr. Buller, made the following report:—

> " Two Treatises on the Natural History of the Pilchard have been submitted to us, which appear to fulfil the conditions prescribed by John Buller, Esq. Both possess merit, but we are of the judgment that the essay by J. C. has the superior claim to the premium of 10*l*. 10*s*.
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> " In making this award, we exclude from our consideration some controversial comments, contained in this paper, relative to the comparative merits, antiquity, &c., of the two modes of conducting the pilchard fishery with seans and drift-nets. We recommend that the opinions of the author on these disputed points be omitted, if his treatise be published, and that there be introduced in the form of a note or supplement, some interesting extracts from the other treatise.
>
> " We think it desirable that a bronze medal be presented to the author of the last-mentioned essay.
>
> " We earnestly recommend that encouragement be afforded by the Society, to the further prosecution of inquiry into the history and habits of the pilchard—to the practical trial of various methods of attracting the fish to the shore—to the discovery of some contrivance for catching shoals of pilchards in deep water with facility and safety—and of a simple plan for destroying or preventing the attacks of " skippers," with which these fish are occasionally infested in the cellars—and to the curing of pilchards as red-herrings are cured—and in a cheaper and more expeditious manner for exportation; such, for insfance, as that practised on the coast of Spain.
>
> " It will also be a matter of much interest, and perhaps of utility, to trace the history of the pilchard fishery during the last 200 years or more, with a view to ascertain the various modes of catching pilchards adopted by our ancestors—the number of hogsheads taken annually—the quantity consumed in Cornwall and Devonshire—and the prices obtained at different periods, for the fish sold when fresh or when ready for shipment. Also the number of complete seans and of drift-nets employed, with a statement of their value, and the amount of capital and persons employed afloat and ashore, in the prosecution of this extremely interesting and beneficial pursuit.
>
> " We trust that the gentleman who has so liberally offered the premium of 10*l*. 10*s*. on the present occasion, will, at a future period, have the satisfaction of finding that he has conduced materially to the well-being and success of one of the most prominent interests of Cornwall."

One of the Lander prizes, offered by Charles Fox, Esq., Perran, was awarded to Mr. G. Wheatley, Falmouth, for a Map of Peru.

The prizes having been delivered, Mr. Gilbert announced that the Rev. Canon Rogers had offered a prize of 10*l*. for the best mode of lighting mines; after which Sir C. Lemon proposed that the thanks of the Meeting should be given to the Chairman for the kindness and ability with which he had discharged the duties of that office. This motion was agreed to unanimously, and Mr. Gilbert returned thanks in a short speech.

On Wednesday, Sir C. Lemon in the chair, it was proposed and carried, that a silver Medal of the Society should be presented to the King, as a testimony of the gratitude felt by the Society for his Majesty's condescension in patronising the Institution; and that silver medals should also be presented to Davies Gilbert, Esq., the President, and Mr. Watt, the descendant of the celebrated James Watt, whose resemblance the medal bears.

Amongst the articles that attracted attention were the following:—

An *Air-Pump*, by Mr. Jordan, on a new construction. Its merits consist in the application of a rotary motion, whereby the certainty of the piston's descending to the bottom of the cylinder is insured; and the *mechanical* movement of the valve effects a more perfect vacuum than has been hitherto obtained, so far as our knowledge extends.

Laocoon—The award of a silver medal for this piece of sculpture, in relief, on slate, elicited unusual approbation. It was copied from an engraving on wood in the *Penny Magazine*, by a youth of sixteen years of age, named Burnard, a mason, residing at Fowey, without any instruction in the art, and with tools made by himself, or by a blacksmith under his direction. Much curiosity was evinced by the company to see this extraordinary genius; who, under the fostering care of those disposed to assist and reward native talent, may one day shine in the annals of our county.

Model of a Machine for Measuring and Indicating the Length and Number of Strokes performed by the Steam-Engine, by Mr. M. Loam.—This machine consists of a notched cylinder connected by wheel-work with several dials, intended to register the work performed by the engine; the first dial registering every 10 feet of stroke, the second every 100, and so on in a geometrical series, whose ratio is 10 feet. These dials may be increased or decreased, to suit the views of those who use the machine. We believe there is a trifling error in the dials for the purpose intended, as they indicate the measure of the arc performed instead of its tangent; this, we suppose, can be rectified.—There was another model exhibited, on the same principle, by Mr. Hosking, of Perran Wharf; and a plan by Mr. Phillips, of Halsetown; both of considerable merit, as the prize list indicates.

The premium for the best *Plan and Model for Raising Miners out of the Mines* was not awarded, but the bronze medal was given to Mr. M. Loam, for a model exhibited by him as possessing simplicity and merit. And on the second day of the exhibition a reward of Three Pounds from Friends of the Society, was presented to Mr. Phillips, of Halsetown, for his model, worked by a steam-engine, by sliding ladders, and moveable platforms. Independent of its machinery, one advantage of Mr. P.'s model, and which we have not noticed in any yet exhibited, is the convenience for the miners ascending and descending by the ladders, in the event of the engine being stopped.

The *Portable Punching Press*, by Mr. Hosking, is likely to abridge the labour and expense of repairing the boilers of steam-packets, &c., as they have only to carry the press to the vessel, which will supersede the present tedious plan of carrying and re-carrying the materials before the holes can be completed. The press and materialsp may now be carried to the steamer, and com leted without further trouble.

New Wheel Wrench, by Mr. Loam.—This simple but useful instrument has been for some time used by Mr. Loam, but will now be more publicly known. It will materially abridge the labour of the artisan in confined situations; and hence one use of the Society in bringing the ingenuity of particular establishments to more public use.

Mr. R. W. Fox, with his usual zeal and condescension, exhibited and explained to the visitors the effects produced by a magnet placed within a globe, which were in accordance with the known laws of the variation and dip of the needle.

Mr. Dobb's *Improved Clock* was exhibited in a beautiful carved model of the west front of Lichfield Cathedral, executed by a cabinet-maker of Helston. The working part of the clock is a *detached Lever, jewelled* in *eight holes*, with plain balance, and has a striking train attached, which strikes the hour regularly, and may be made to repeat it whenever required, with a distinct and sonorous sound. It is allowed, by competent judges, to be highly finished, and original in design and execution. It was escaped, finished, and *jewelled*, by Mr. Dobb, at Helston.

Captain T. Richards's ingenious *Plan for Measuring the Supply to the Boiler of a Steam-Engine*, was greatly admired for its simplicity.

There was received too late for the exhibition a model of an improved printing-press, by Mr. John Trevillian, of Camborne, by which an increase of power is given to the impression by three levers being brought perpendicular within the hollow of the piston. The press is of simple construction, and will, we think, if introduced to the trade, obtain their patronage.

We are enabled by the kindness of the Secretary of this valuable, and, we are glad to perceive, flourishing institution, to add to the preceding extracts from the *Falmouth Packet*, the fuller account which follows, of the interesting communications made to the Society by Mr. R. W. Fox.

Mr. R. W. Fox exhibited a chart, illustrating by curves the inclination of the dipping-needle, and the relative intensity of the magnetic force, in various parts of Ireland, also of England and Wales. This gentleman has recently made a series of observations with his "dipping-needle deflector," which was described in the last report of the Polytechnic Society; and the results given in the chart seem likely to interest the scientific world, inasmuch as they indicate an increase in the dip in the mountainous districts which he visited, particularly on the top of Snowdon; and they also show, that the curves of equal dip between this island and Ireland are not continuous; but that there is an interruption or break in them of about half a degree, *i. e.*, the curve representing the dip of 71°, which passes near Dublin, is found again in Carnarvonshire, instead of in Cumberland, as its direction in Ireland might be supposed to indicate.

Mr. Fox infers from this circumstance, and from the other curves in England and Ireland appearing to harmonise with each other, that this phenomenon is due to the superior attraction of the land as compared with the Irish sea; the former causing a deflection downwards, or greater inclination of the terrestrial magnetism than the latter. Mr. Fox anticipates that these facts may tend to connect the phenomena of magnetism with those of geology more than has hitherto been the case, as the influence of the land on the direction of the former is probably general, and independent of any attraction of a merely local nature, caused by the presence of iron, &c. Meteorological phenomena also may be found to have some reference to the increased dip in mountainous districts. Mr. Fox's new dipping needle has exceeded his most sanguine expectations; and the results of the dip and intensity obtained at about forty stations, together with a copy of the chart, will be given in the next report of the Society.

Mr. Fox also endeavoured to

trate, by means of a chart

trial globe, containing magnets, his views of the causes of the periodical changes in the direction of the magnetic needle. Besides the lines of no variation which pass through the magnetic poles of the earth, there must be other lines of no variation alternating with them, and passing through those places where the horizontal needle is equally acted upon by the two forces. It appears that two lines of no variation have been observed near the eastern and western boundaries of Asia, which may therefore be assumed to be the lines in question, and they indicate that the Siberian pole is inferior in intensity to that in North America. If the force of the latter should increase, and that of the former should diminish, the lines of no variation will consequently recede from the Siberian, and approach the American pole; thus slowly oscillating, as it were, between them, whilst the poles themselves remain stationary. It is stated that the mariner's compass has not been observed to undergo any change in its direction in Jamaica, or in Australia, for the last 150 years; which fact seems inconsistent with the generally received notion of the rotation of the magnetic poles from east to west, these places being situated near the stationary lines of no variation. As the line of no variation passed over London in the year 1660, and over Paris and Copenhagen some years afterwards, it seems clear that it must have passed from east to west, these cities being some degrees eastward of London; and this is in strict accordance with Mr. Fox's theory of oscillation. It may be also remarked, as a curious coincidence, to say the least of it, that the two magnetic poles should be situated near the northern central parts of the two great continents of the world. It may be somewhat difficult to explain why there should be an alternating intensity in the magnetic poles, but not more so surely, than to account for their assumed rotation; nor does it seem so inconsistent with known electrical phenomena, as the hypothesis of the poles revolving in unequal times. If the phenomena of terrestrial magnetism depend on electrical currents circulating through the mineral veins and strata of the earth, the general oblique direction of these from nearly N.E. to W. would *necessarily tend to produce* at least two poles in each hemisphere, as stated by Mr. Fox in his communication to the Royal Society, in his paper on the electro-magnetism of veins, published in 1830; and the fact he has ascertained from his observations in England and Ireland, seem to have a strong bearing on this part of the subject.

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MR. ARCHIBALD ROSSER.

On Saturday, the 24th inst., Captain Lorraine White, delivered to me the letter of which the following is a copy:—

"15, New Boswell-court,
24th Oct, 1835.

"Sir,—The remarks you have made on me in your periodical published this day, leave me no alternative but to request you will name some gentleman who will, with the bearer, my friend, Captain White, arrange the preliminary steps for my receiving the usual satisfaction in cases of attack upon honour.

"I am, Sir,
"Your obedient servant,
"ARCHIBALD ROSSER.

"J. C. Robertson, Esq."

Captain White, after delivering the letter, stated verbally that he was open to receive such a disavowal from me as would make the extremities contemplated by it unnecessary. I made for answer, that if Mr. Rosser would only make good the public contradiction which he had volunteered of my statements with respect to the working of the Patent Law Amendment Act, that is to say, would prove the truth of his positive and unqualified assertion, that "a specification had been amended under the Act, the Attorney-General and Solicitor-General concurring in the *modus operandi*," I would instantly retract every offensive expression I had made use of respecting him; but that I could not, under my existing convictions, say or do any thing which could be construed into an admission of the correctness of that assertion. Captain White withdrew to consult with his principal on the subject. On his return he stated that nothing less would satisfy Mr. Rosser than an express disavowal of any intention to impute to him wilful falsehood. I replied that I had no objection to say that I believed he had acted on the information of others; but I pointed out to the notice of Captain White, that though he had verbally offered an alternative, which should supersede the supposed occasion for a meeting, the letter he had delivered contained no such alternative, and that unless, therefore, that letter was withdrawn, I could not and would not give even that, or any other explanation whatever. Captain White then took back the letter, that he might advise with Mr. Rosser as to its withdrawal. On his return a second time, Captain White stated, that if I would only say verbally that I had no intention to impeach Mr. Rosser's character as a man of honour and veracity, that would suffice, and the matter might drop. I declined giving any such general certificate of character, and Captain White thereupon redelivered the letter, on which I arranged that a friend of mine should meet him on the subject next day at two o'clock. What followed will be found stated in the following memorandum furnished to me by my friend Mr. Thompson.

J. C. Robertson.

6, Peterborough-court, Oct. 29, 1835.

MEMORANDUM.

7, Adelphi Chambers,
12 o'Clock, P. M. Tuesday.

Mr. J. C. Robertson having handed to me a letter which had been delivered to him by Captain L. White, on the part of Mr. Archibald Rosser, and placed the affair in my hands to arrange as I might judge best, I had an interview with Captain White, on the subject, at the Union Club-house, on Sunday. Captain White commenced conversation, by expressing his readiness to accept of a disclamation from Mr. Robertson, of any intention to impugn Mr. Rosser's character as a man of honour, veracity, and integrity. I stated, that as the letter from Mr. Rosser, himself, did not contain the alternative of an explanation, I could not, on Mr. Robertson's behalf, entertain any proposition of the kind, until that letter was withdrawn. Captain White replied, that since such was my view of the matter he would destroy the letter; and he accordingly threw it into the fire. We then discussed the sort of explanation which should be given by Mr. Robertson, but could not, at the time, agree on what it would be proper for him to assent to. I saw Captain White again, on the subject, in the early part of this afternoon, when he presented to me a form of explanation for my approval, which appeared to me to be altogether inadmissible, but I promised to wait upon him at 10 o'clock to-night, by which time I would have a draft prepared, agreeably to my ideas of what honour and propriety dictated. I accordingly saw Captain White about an hour ago and gave him a paper, of which the following is a copy, as containing the only explanation which I thought Mr. Robertson, as a gentleman, called upon to give:—

"At Mr. Archibald Rosser's request, we give the following explation of our remarks respecting that gentleman, in the last number of the *Mechanics Magazine*. We there stated that Mr. Rosser's assertion, that a specification had been amended under the Act, the Attorney-General and Solicitor-General, concurring in the *modus operandi* was "wholly false;" but we did not, and do not, intend to impute to Mr. Rosser, that he was guilty therein of intentional falsehood. We believe that Mr. Rosser was informed, by some person or persons, that such was the case; and had Mr. Rosser but stated in the first instance, that he made the assertion not on his own authority, but on the authority of others, we should at once, and spontaneously, have acquitted him of all intentional misrepresentation."

Captain White said that such an explanation would not suffice, and then talked of making arrangements for a meeting to morrow at 12 o'clock. But as there was no longer any challenge existing, and as I had already tendered on Mr. Robertson's part, all the satisfaction to which I considered Mr. Rosser entitled at his hands, I declined to proceed any further in the matter.

J. Thompson.

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal* for Sept.)

Improved Theodolite, or Surveyor's Compass, *James Eames*, *Newry*.—The patentee says, that, in the first place, he takes "the circumferentor, without the usual index, and forms the outside of the box so as to preserve one side straight, parallel with the north and south line under the needle in the card."—Secondly, he takes "the protractor, adding two lines, one to show the swag of the chain, the other the rise and fall of the uneven lands, attaching it to the straight side of the compass, so as to hang perpendicular." Thirdly, he takes "the tube, or index, with prospect glasses inside of said tube, and attaches it to the compass on the outside of the protractor, in such a manner as to move round like the index of the theodolite, when placed for taking heights, &c." When the compass has been placed and levelled, the tube may be raised so as to descry the object, when, by casting the eye upon the protractor, where the first end of the tube intersects the lines thereon, the degrees, the swag of the chain, and the rise of land for a certain distance, are perceived. In descending ground, by lowering the tube, taking the object, and casting the eye upon the protractor, directly under the further end of the tube, where it intersects the lines of the protractor, the swag of the chain, and the descent of the ground, are seen. The claim is to "the above described machine, in bringing the several instruments together in my new invented way, as before described."

Machine for Shelling Corn, *J. H. Taylor and A. J. Cowley, New York*. This machine differs considerably from all those for the same purpose which we have had occasion to examine, but a full description of it would require more time and space than we are, at the present moment, disposed to afford. A cast iron wheel, fifteen inches in diameter, is made to revolve, vertically, by means of a winch; this wheel has spurs, or points, on each side, to aid in shelling the corn, and on its edge there are teeth, which give motion to a wheel, or pinion, on a second shaft; this second shaft carries two cast-iron wheels, one foot in diameter, embracing the main wheel, first described, between them; each of these wheels has a wide rim cast on it, which inclines inwards towards the main wheel, reducing the interior diameter to ten inches; upon these rims there are cross teeth, upon which the ears of corn are fed, being made to run down two inclined troughs, or hoppers, when, by the combined motion of the main and secondary wheels, the ears are made to revolve, and the grain is shelled off. So far as the drawing and description enable us to judge of the operation of this machine, we are disposed to form a very favourable opinion of it; we think that it is ingeniously contrived, and has sufficient originality.

Improvement in the Machinery for Manufacturing Paper, *J. Ames, Springfield*.—This patent is taken for the manner of applying a drying cylinder to machines for manufacturing paper. Those acquainted with these machines, know that the paper, after passing through the press rollers, is subjected to the action of large hollow cylinders, by passing over which it is effectually dried, these cylinders being heated by steam or hot air, which passes into them through a hollow gudgeon. The patentee substitutes the drying cylinder for the upper press roller; these cylinders are, in preference, made of cast-iron, and from nine to twelve feet in diameter; the lower press roller is to be borne up against the cylinder by means of weighed levers, with such force as to cause the drying cylinder to revolve.

The claim is, to "the use and application of the said cylinder, as a substitute for said upper and main press roller, in the machines which have heretofore been in use for paper making, and in the connexion and combination with the said lower press roller, or rollers, in the manner, and for the use and purposes aforesaid."

Composition for rendering Roofs Water-proof, &c., *Lyman Garfield, Troy, New York*.—The composition spoken of is to be used "for the purpose of making the roofs of buildings water-proof—for lining floors, walls, aqueducts, and vessels for holding or passing water, and for cementing the parts of vessels; also for making door and window caps, and sills, where free-stone is now used; also to any wood-work, to prevent leaks, and the lining of baths, sinks, and water-spouts; and for making stoves, fire-places, furnaces, jams, and mantel-pieces—by uniting sand, water-lime, ashes, the earths, or alkalies, clay, oil, and copal varnish, with or without dissolved India rubber, or caoutchouc."

The foregoing quotation is from the petition, and refers to so many things, that we were led to anticipate, in the specification, a voluminous description of the processes necessary to carry the whole into operation; this, however, we have found to be vague and indefinite, as will appear from the epitome we are about to furnish.

To make roofs water-proof, we are directed to "dissolve caoutchouc in spirits of turpentine or seneca oil, and then evaporate the turpentine, or seneca oil, by alcohol, so as to form a paste," which is to be spread upon the roof by any suitable instrument;—sand, water, lime, and coal-ashes, in equal parts, are then to be sifted over it (or sand, ashes, and earth, may be used), and pressed down; or the whole materials are to be mixed to the consistence of mortar, and spread by means of a trowel. Parts of buildings, or vessels, decks, and awnings, whether of wood or cloth, are to be treated in the same way.

To the dissolved India rubber may be added, any of the earths, or alkalies, whether silicious or otherwise, or anthracite coal ashes, or wood ashes, or water lime, or "the combination of any or all of these." Or the following composition is to be used for the same purpose:—equal parts of sand and ashes, anthracite coal ashes being preferred; mix with oil and copal varnish, about one-fourth copal varnish, or some other varnish of a hardening quality. The sand and ashes must be mixed soft enough to enable the operator to spread it upon the roof with a trowel."

Water lime, sand, and anthracite coal ashes, are to be employed for making window and door caps, sills, sinks, pipes, &c.—sand or gravel, or sand and coal ashes, from one to ten parts, to one part of water lime. For resisting fire, a small portion of pipe, or other clay, may be added.

The patentee has not made any claim, or told us in what the novelty of his plan con sists; nor, from the tenor of his remarks, should we suppose that he has made any adequate trials of his own prescriptions, if such they may be called, when given in terms so loose and indefinite. His first composition has a basis of India rubber, whilst in his other this substance is not used at all; his patent, therefore, is for things entirely dissimilar and distinct from each other; and these, if valuable, ought therefore to have been made the subjects of separate patents.

Plough, *B. Johnson, Hickory Grove.*—There are three things mentioned as improvements on the common Carey, or Bull-plough, two of them refer to the manner of forming the wood-work of the plough, and the attaching the parts together; the third relates to the construction of the mould-board, which is to be formed into three parallel ribs, behind the wing, which may be from one to two and a half inches wide, and have spaces of corresponding width between them. The advantages of this improvement are said to be, "that the draft is rendered much lighter in consequence of there being less friction, the spaces between the ribs preventing that clogging and accumulation of earth and soil, common to the mould-board; and that all or any part of the ribs can be taken off at pleasure, and a heavy plough made light, according to the work to be performed."

Percussion Lock, *Thomas Daplyn, Ohio.*—The lock here patented is so constructed, that it can be removed instantaneously from the stock. For this purpose, all its acting parts are contained within a thin case, which drops into a mortise made through the stock, the hammer projecting above, and the trigger below, the case. By pressing the thumb upon a catch, the lock is released, and may be carried in the pocket—when wanted for use, it is merely dropped into the mortise.—The lock appears to be well constructed, its parts being so arranged as to adapt it to the form given to it, without interfering with its operation. The claims are to "the manner of inserting the lock in the stock," and to "the manner of construction, or the mode of putting the lock together, in all its parts."

Machine for Cutting Meat, *John Morris, Derby.* This machine is not intended to cut meat in the manner of the ordinary sausage-meat cutters, into minute particles, but into longitudinal shreds. The meat, separated from the bones, is to be put into a cylindrical vessel, or hopper, and a knife, of a peculiar construction, revolving horizontally, divides, or cuts, it into plates, whilst others, which are short, descending vertically, divide it into strips. We cannot attempt to give the construction and operation of the machine in detail, these occupying half a dozen pages in the specification. The patentee enumerates advantages in his machine, some of which appear to us to be overrated. He says that, "among those obvious, are the rendering soft and tender the parts of the flesh of animals naturally hard, and difficult of mastication. The preserving all the juices entire, and thereby avoiding the waste of them incident to the most common modes of preserving and preparing it for food, and thus retaining unexpended the peculiar flavour of each kind. And the facility of applying instantly, at all seasons, to each minute part of it, the means of preservation and seasoning, without incurring the danger of putrefaction consequent on the slow action of those means upon large masses, in the present mode of curing them."

We do not believe that our housewives, or epicures, will consent to have our hams, and rounds of beef cut into shreds, and thus salted and served up, instead of having them presented in all their native beauty of form, exhibiting their well-arranged layers of fat, and layers of lean, with which the idea of their excellence is so intimately associated.

Machine for Thrashing Grain, *Joseph Ross, Boundbrook.* "I make that part which is usually denominated the cylinder in thrashing machines, smaller in the middle than at the two ends, so that, instead of being a cylinder, it is, in fact, formed by the union of two truncated cones, at their smaller ends. The difference of diameter between the middle and ends may be about 1 inch; I prefer not to make the difference greater, as I can then use a concave, which is straight longitudinally, whilst, if the cylindrical part were made much smaller in the middle, it would be necessary to make the concave conform thereto, by giving it a rise in the centre; but I usually make the teeth driven into the cylinder to vary in length, so that their outer ends will, in revolving, pass each at the same distance from the concave.

"I drive teeth into the cylindrical body, which teeth project from an inch to an inch and a half, and also drive similar teeth into the concave; these teeth may be of square three-eighths iron. I do not drive them straight, but incline them in both, in such a way as shall tend to prevent their breaking the straw, their slope separating them readily therefrom.

"I usually cover the cylinder and concave with sheet-iron, as this tends to render them the more durable.

"In the frame of my shelling machine, this cylinder and concave may be substituted for the shelling apparatus, so that the one or the other may be used at pleasure; or I place this cylinder and concave in a suitable frame, without reference to the shelling-machine; in either case, a proper feeding table, or any other well-known contrivance for that purıy be used. The only thing which I new, is the form given to what is denominated the cylinder, by making er at the centre than at the ends, as lescribed; the effect of which, it has perimentally proved, is to prevent ıoyance from the current of wind and oduced in other machines for thrash- n.

ıough I have spoken of the revolving formed by the union of two truncated ıe effect will be similar if, instead of he double cone, as described, the be made concave, in a regular curve, its diameter in the middle, so that be an inch, or upwards, less there the two ends.—JOSEPH ROSS."

IINE FOR CLEANING CLOVER AND SEEDS, *Joseph Ross, Boundbrook.* onstruct a frame to sustain a hori- cylinder, and other parts of the appa- o be presently described. The cy- may vary in length and diameter, ng to the power by which it is to be The cylinder is to be set with teeth kinds; one set of teeth may be from rth to half an inch in length. These ircles round the cylinder, the circles an inch, more or less, apart. Be- these, rows of long teeth, wires, or are driven, which could not stand ıre than one-sixteenth of an inch, ffice being to rub the seed from the a similar effect may be produced by g the cylinder with punched sheet in other well-known ways.

ıse a concave which surrounds the cy- or about three-quarters of its circum- . The part directly under the cylin- tending about one-quarter of its cir- ence, may be of punched sheet-iron, or wire, with meshes of such size as will the seed, but not the chaff, to pass h. The remaining part of the con- xtending up to the apex of the cylin- nay be left smooth. The distance be- the cylinder and the concave must be nt for the passage of the larger teeth. he seed to be hulled is put into a hop- ove the cylinder, the opening through ttom thereof extending the whole of the cylinder. In front of the cylin- employ rubbers, which are made by wide strips of sole leather, the length cylinder, there being three, four, or such strips; these I confine between of thin board, one piece being placed n each strip. The edge of the leather, it touches the cylinder, projects beyond n boards, so as to give it the necessary each piece of leather is so notched as w the longer teeth to pass. The lea- ıbber, thus formed, slides in against nder, and is, therefore, capable of being adjusted so as to press against it with greater or less force.

"When the seed has passed the leather rubbers, the greater part of it falls through an opening on to the floor, whilst the chaff and the remaining seed are, by the action of the longer teeth, carried immediately over the perforated iron, or the meshes of wire-work, of which the lower part of the concave is formed.

"At the point where the smooth part of the concave commences, an opening may be made by lowering the bottom part of the concave, which is hinged in front for that purpose. Stones, or other hard substances, may be thus readily removed. A strip of leather is fixed along the edge of this opening, which extends to the cylinder, serving to check the too free passage of the seed round with the chaff, whilst, by its elasticity, it will allow the long teeth to carry the chaff beyond it. The back edge of the hopper has also a similar piece of teether upon it, which extends to the cylinder, and arrests the chaff, causing it to be blown out through an opening immediately behind the hopper, whilst that which contains seed will, from its greater weight, be retained, and pass the leather, to be again rubbed.

"What I claim as new in the foregoing machine is the combination of long and short teeth in the cylinder, operatinr in the manner, and for the purposes, set forth. I also claim the leather rubber, constructed and acting in the manner described; not intending, by these claims, to limit myself to the precise arrangement set forth, but to vary the same in any way, whilst I produce the same effects by machinery operating substantially upon the same principle.—JOSEPH ROSS."

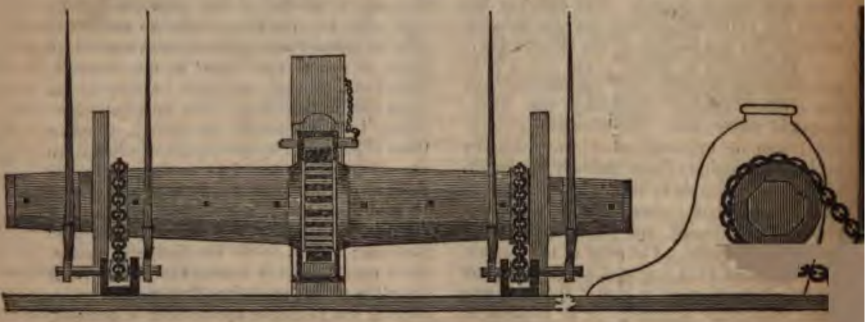
IMPROVED PLOUGH, *Nathan Robinson, New York.*—"The body of the plough is best made of cast-iron, as such instruments are now usually made, but the improvements which I have made are independent of the material, consisting of such alterations in its form and relative dimensions as are calculated to obviate the objections most commonly made to the ploughs now in use, namely, their running hard, and their liability to become choked with dirt. The principal alterations I have made in the plough, to effect these objects, are by giving greater length to the body of it, and less curvature to the mould-board, than have usually been given. In describing these improvements, I shall set down certain precise measurements and proportions; but it is to be distinctly understood that I do not intend thereby to limit myself in these particulars, but merely to exemplify the principle upon which I proceed, and to give information to those who might otherwise be at some loss in carrying my plan into operation.

" From the point, or nose, of my plough, to the junction of the shank and mould-board, it is formed to a radius of about 72 inches, keeping the same curvature, or nearly the same, through to the hinder part of the mould-board, this being about the medium convexity which the under side of the furrow slice naturally takes in being raised and turned over. From the commencement of the circle at the point, or nose, I sweep up till I have raised the share of my plough about 10 inches from the bottom of the land side, this being the seat, or junction, of the stem to the mould-board; presenting a thin, flat wedge, and a nearly straight ascending plane, of about 20 inches to the earth. At this point the furrow slice lies on an angle of 31° from the surface of the earth from which it is raised. From the junction of the shank to the mould-board, I run back on a straight line about 28 inches, and on an angle of about 40° with the land side, making my plough about 21 inches wide at the hind part. My share I proportion in length to the other parts of my plough; commencing about 2 inches above the point, I draw a line back on about the same angle with the land side that the upper edge of the mould-board has, till I have obtained a sufficient width from the land side, which is about 12 inches. The long edge, which is thus presented to the furrow slice, separates it readily and evenly from the solid earth. At the termination of my share, which is about 16 inches from the starting-place, at the point, I turn an angle in the lower part of my mould-board, in the usual manner; but I carry the bottom edge of the mould-board back even with the bottom edge of the land side, leaving the heel thereof as many inches from the land side as the share is at the widest point; these three points then stand at right angles with each other. The bottom of my plough being about 30 inches long, I make the hind end of my mould-board to slope back sufficiently to give to my plough a length of about 47 inches from the point, or nose, to the extreme point of the mould-board.

" I will now give some further particulars respecting the relative dimensions of my plough, taken from one which I have made, and the operation of which I have tested by satisfactory experiments. Share on an angle of 31° with the bottom of the land side; the upper edge of the mould-board is at an angle with the land side flat-wise, 40°; the edge of the share with the land side, 32°; length of the plough on the bottom of the shank to the point of the mould-board, 30 inches; the edge of the share, 17 inches; from the termination of the share to the heel of the mould-board, 13 inches; cutting width at the point of the share, 11½ inches; parting off width on the bottom, 11½ inches; circle of the shin, 72 inches radius; circle of the concavity of the mould-board, nearly the same; from the nose to the extreme point of the mould-board, 46 inches; width of the mould-board, 13 inches; overjet, 7½ inches.

" It will be manifest to any person that these measurements may be departed from, to a certaint extent, without thereby essentially altering the character of my plough; and it will also be evident to those who are acquainted with the construction of ploughs in general, that the form which I have given to mine, by proportioning the different parts to each other, is such as impresses upon it a character by which it will be readily distinguished from others. What I claim, therefore, as my invention, is a plough formed upon the principles, or in the manner, herein set forth, by which it is made to run more easily and cleanly than those now in uses.—NATM ANROBINSON."

YOUNG'S PATENT INCREASED PURCHASE FOR SHIPS' WINDLASSES.



Sir,—Next in importance to the security of a ship's windlass, which is now so completely effected by the patent pall and riding chock, of which you have given place to a description in your last magazine (page 41), are improvements by which a greater power can be given to its action, than by the common application of the handspike. For, however well adapted it may be, when the resistance to be overcome is much less than the power which can be so applied, it is a fact, well known to seafaring men, that there are times when the utmost exertions of the whole ship's company, by such means, are unequal to purchasing the anchor. And it still more frequently happens, that by their long repeated efforts, they are unable to advance the pall cylinder even one tooth in its revolution, that is, to bring in about two inches of the cable, until aided by some lucky wave or changed position of the vessel: consequently, in such cases, much time and strength are expended before a vessel can be got under way, merely for want of additional power. This has led to various mechanical contrivances, most of which have been modifications of the cog-wheel and pinion, but which have severally proved defective and unfit for the causualties to which they are exposed on ship-board, particularly from the changes which take place in the distances of the centres, by the straining of the windlass, bits, or timbers, whereon they may be fixed. Complicated machinery, however powerful, is decidedly objectionable. Indeed, any apparatus to be applied to a ship's windlass should be simple in its construction, direct in its action, compact, strong, and not liable to be deranged, and withal, not too expensive. That *Young's patent purchase*, of which I herewith send you a description, combines these properties, will be readily admitted by those of your readers who are particularly acquainted with the working of a ship's windlass, as it is also by those who have adopted it in its present complete state.

Fig. 1, is a back elevation of a ship's windlass and bits, fitted with Sowerby's patent pall and riding-chock in the middle, and Young's patent purchase at each end within the garrick bits.

Fig. 2, shows a section of the windlass body, and an end view of the purchase and starboard *garrick bits*.

The patent purchase consists of a strong cast-iron wheel, firmly wedged upon the body, with semi-elliptic cavities in its surface, adapted to hold the sides of the link of a chain which embraces it, and a pinion with similar cavities in its surface. The pinion is keyed upon an iron axle, working in a carriage placed on the deck, and bolted down to a beam abaft the windlass. Ratchets are also keyed upon each end of the axle, and worked by a palling box, from which a socket arm is continued for receiving the handspike. The two ends of the chain are connected by a shackle made on the segment of a link, so that it also fits the cavities in the wheel and pinion. The chain may be tightened or slackened by means of adjusting wedges, which are fitted on the carriage. The drawings represent the handspikes in their places, which, on being depressed, bring the pinion round, and with it the windlass body, with a power proportioned to the size of the wheel to that of the pinion. The usual proportions adopted are about four to one; consequently, one man using the purchase, is nearly equal to four men applied to the windlass in the usual way. Hence, with it, a small number of hands may get the anchor, when the whole ship's company would be unable to do so without it. In addition to its great power, it possesses other important advantages, a few of which I shall briefly enumerate as follows:—It is not liable to be injured by the heaving or pitching of the vessel in a heavy sea; the endless chain which embraces the two wheels fixed upon the windlass body and axle not being tight, but passing easily and loosely round them, added to the peculiar form of the wheels, renders them incapable of being thereby deranged or broken. The men can with the same handspike, at pleasure, use the common windlass, or take advantage of the patent purchase, their faces being always towards the ship's bow. The handspikes not requiring to be taken out (as they fleet themselves by the ratchets), no time is lost in re-inserting them, as with the common windlass alone. Should the cable ride, or a handspike foul, it allows the windlass to be turned backward. It is a considerable security to the windlass necks, as its pull is in an opposite direction to that of the anchor, and when riding, it answers as an extra riding-chock. It offers no obstruction to the free use of the windlass, having no spindle passing from bit to bit; no wheel projecting beyond the bits, and preventing the weather-bitting of the cable—no cog machinery to be deranged—whenever the windlass requires to be unshipped, the chain may be taken off in a few minutes. It may be fitted to one or both ends, or to the middle, even in a few hours, if necessary. It is admirably adapted to large vessels, as the chains may be carried to any convenient distance; and, if required, the speed of the windlass increased, by adopting a larger pinion. Its construction and action are so simple, as to render it unnecessary to encroach further upon your valuable pages, unless it be to say, that it is also the cheapest purchase which has hitherto been applied to a ship's windlass.

Yours respectfully,
T. Sowerby.

Patent Windlass Works, near Shadwell
Dock Basin, London, Oct. 21, 1835.

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WAXING MARBLE.

Extract from the Evidence of Mr. John Henning upon the Committee of Arts and Manufactures.

What means were used to preserve the frieze of the Athenæum and Hyde Park-corner from injury from the atmosphere of London?—It was waxed.

Were you the author of that mode?—I do not know if any other person had done it, but the first experiment I made was on a piece of polished marble. I took wax, and made a stripe across it with a hair pencil; I contrived to warm it till the marble had absorbed the wax, and left none on the surface. Then I mixed wax with a little turpentine, and I found that it went in further, but I found that the wax went one-sixteenth of an inch into the marble. I put it on the top of the house for one winter. I found in the spring the polish was all off the marble, except where the wax was; that convinced me it must be of some use; and just about the same time I was employed to do a medallion of my friend, Dr. Adam Ferguson, to be placed on his monument. I asked if the family would allow me to do it with wax. It was a piece of very beautiful statuary marble. I did it in this way, and Lord Burghersh having called on me, and looking at it, he asked where I had got such *marble? I told his Lordship that I had saturated it with wax, under the impression* that it would preserve it in the open air. I showed him the piece of marble on which I had made the experiment—and it arose from that circumstance.

Does it give marble any unpleasant gloss or polish?—No; it makes it like the finest preserved old marble that ever was seen.

How do you apply the wax to the marble?—We warm the wax; we have the marble warm also; and I take off any thing that is upon the stone, and leave nothing but what is within the stone.

You must warm the whole bust or statue?—Yes; and have my wax as hot as I can have it; and take the best means to set off the superfluous matter. I take it off with soft cloth, or with cotton.

You also dissolve it in turpentine?—Yes; but it goes in so far, the wax, by itself, that it is hardly worth while: I believe wax is almost indestructible in the open air.

If it were a large statue, would it answer to have the turpentine wax dissolved and put on the whole statue?—I would begin at the top of the head of the statue, and have the wax as warm as I could have it, and have heated irons, so that I could, without touching the statue, let it come down to the bottom; and you must have it clean.

Is it fine wax?—Yes; but I suppose other wax will do it very well, for defending stone. The white makes the least change of colour.

What do you consider the great advantage of this application of wax to marble?—It was, as I conceived, the marble getting into the stone, froze and destroyed it.

You consider the great advantage of your discovery is the preservation of the material?—That was my impression. I do not know if it deserves the name of a discovery; for any thing that I know, ten thousand may have thought of and done it before me.

Is any other object attained by it?—Not that I know of. It takes away the glaring white of the marble, and gives a softened tone to the whole—much like the best preserved old marbles that I have seen.

How long does marble so coloured

he effects ?—I think from what
seen of wax, it is more inde-
in the open air, than any
aterial I know.

NOTES AND NOTICES.

avigation between England and America.
ntemplated establishment of a line of
kets between the ports of New York and
has excited a good deal of interest in the
y. The *Evening Star*, alluding to this
ys: "If the project formed by Captain
others, to build steam-ships to navigate
is port and Liverpool, succeed, and they
t to abandon a matured project, there
end to our splendid packet-ships, so far
ers are concerned; for although it is some-
ult to combat with water, without encoun-
difficulties of fire, yet one or two safe
ill so inspire confidence, that the com-
xpedition of the voyage will crowd those
h travellers, and, in time, going to Li-
ll require as little preparation as it for-
to go to Albany. They must, however,
rge ships, say from 800 to 1,000 tons bur-
uilt with every possible strength, with
gines, and room for at least twelve days'
ave first rate captains and engineers."

leave to call the attention of our agricul-
ds to the following section of the Act
he late session of Parliament, for regulat-
ts and Measures:—Sect. 6. "And be it
at from and after the passing of this Act,
re called the *Winchester bushel*, and the
sure called the Scotch ell, *and all local*
ry measures, shall be abolished; and
on who shall sell by any denomination of
her than one of the imperial measures,
ltiple, or some aliquot part thereof, &c.,
nviction be liable to a penalty not exceed-
every such sale." It follows from this
that the coomb, boll, double bushel, load,
ny other provincial term, is completely
with, and it must be observed that this
Act comes into *immediate* operation.
the heaped measure is also abolished,
gains made thereby are declared void, as
enalty of 40*s*. imposed on the seller.

h between London and Paris.—The line
hic communication between these two
e understand, in process of completion,
rpose of transmitting the prices of the
eriodical times in the different stock-
Mr. Ricardo and a French gentleman
nagers of the undertaking. There are
stations in England—the first in St.
elds, and the last at Folkstone in Kent;
en stations from the coast to Paris.
t is first to be confined to transmitting
of the funds, it is intended hereafter to
the conveyance of other intelligence.
will be conveyed from London to Paris
and a half.

on of the Danube.—There seems every
prospect of the difficulties which have
themselves in the application to the
ing speedily overcome. There are now
-vessels on that river; one between the
nd Fetislaw, a second between Orsova
a third between Pesth and Vienna,
e boat to replace the others in case of

f Ancient Civilisation among the South
s.—Amongst the Caroline Islands, only
ail from Sydney, *is Ascencio* (*about* 11
th latitude), *discovered very lately by*
s sloop of war Raven. Mr. *Ong, now*
this colony, some years back remained
ral months, and we have our informa-
tion from a friend, who conversed frequently with Mr. Ong on the subject. On the above-named island of Ascencio, the language of the inhabitants is more harmonious than in the other islands of the South Seas, a great many words ending with vowels. There are at the north-east end of the island, at a place called Tamen, ruins of a town, now only accessible by boats, the waves reaching to the steps of the houses. The walls are overgrown with bread, cocoa-nut, and other ancient trees, and the ruins occupy a space of two miles and a half. The stones of these edifices are laid bed and quoin, exhibiting irrefutable traces of art far beyond the means of the present savage inhabitants. Some of these hewn stones are 20 feet in length, by 3 to 5 each way, and no remains of cement appear. The walls have door and window places. The ruins are built of stone, which is different from that occurring in the immediate neighbourhood. There is a mountain in the island, the rocks of which are covered with figures, and there are far greater ruins eight miles in the interior. The habits of these islanders exhibit traces of a different social system; the women do not work exclusively, as is the custom in the other islands. After the meals water is carried about by servants for washing hands, &c. Asked about the origin of these buildings, the inhabitants say, that they were built by men who are now above (pointing to the heavens).—*Hobart Town Courier.*

The mighty chain of the Andes, and the yet more lofty Hamalaya, bear about the same proportion to the earth that a grain of sand does to a globe three feet in diameter.—*Mrs. Somerville.*

French Carts.—After staying a couple of days at Rouen, we proceeded by the same mode of conveyance to St. Germain: we went by the upper road, which is not very interesting. On the way we passed many carts drawn by horses, such as I have described. The construction of these carts struck me as being particularly well adapted to the roads on which they travel. The body is composed of a frame of great length, extending entirely over the shaft horse, and so constructed that, by means of a winch, the frame may be moved backwards and forwards, so as to be balanced on the two wheels which support it. These wheels are large, and stand perfectly upright, with very deep naves, so that they can preserve their perpendicular without difficulty; and the linch-pin is so placed as to allow of considerable horizontal play on the axle, which, on a rough *pav*, is a great advantage. How much superior is this to the wheels of our travelling waggons, the fellies of which, being frustrums of cones, a good deal of power must necessarily be lost in keeping them in a straight line, while the grinding motion thus occasioned must be very injurious to the roads! These carts are also fitted with a contrivance for retarding the revolution of the wheels on descending hills, by pressure of the circumference, to serve instead of a drag.—*From Captain Blakiston's new work, "Twenty Years of Retirement."*

Improvidence of the Poor.—Defoe, the author of "Robinson Crusoe," considered the improvidence of the poor a principal cause of their wretchedness. "We are," says this shrewd observer, "the most *lazy diligent* nation in the world: there is nothing more frequent than for an Englishman to work till he has got his pocket full of money, and then go and be idle, or perhaps drunk, till it is all gone. I once paid six or seven men together on a Saturday night, the least ten shillings, and some thirty shillings, for work, and have seen them go with it directly to the alehouse, lie there till Monday, spend it every penny, and run in debt to boot, and not give a farthing of it to their families, though all of them had wives and children. From hence comes poverty, parish charges, and beggary."—*History of the Middle and Working Classes, Second Edition.*

The Institute of British Architects is receiving contributions and communications of great importance from scientific men both at home and abroad. An essay is advertised for upon the interesting subject of *concrete*, one of the most useful revivals of a mode of construction used by our forefathers that we have had to notice of late years. The architects of our Gothic edifices made most extensive use of concrete in many of their edifices, which remain even at this period as solid as ever. We cannot but anticipate the most favourable results from the exertions and labours of this useful scientific body, and call upon our practical men connected with building of every grade to answer the call which has been made upon their experience by the offer of a premium upon this important point in construction; for if the Institute receive an essay of adequate merit, it will doubtless be printed under their sanction, and be highly useful to all engaged in building operations.

The Railroad System.—There are no less than 23 published plans of railroads now on the *tapis*, including those at present in progress. The total amount of capital proposed to be invested is *twenty-one millions*, and if completed, they would extend over 1,200 miles.

Communications received from Mr. Raikes — Lieut. Wall — Mr. Lunt — Viator — Mr. Mundy — Mechanicus Minimus — Mr. Matthews.

LIST OF NEW PATENTS, GRANTED BETWEEN THE 22D OF SEPTEMBER, AND 23D OF OCTOBER, 1835.

Joel Spiller, of Battersea, engineer, for an improvement or improvements upon boilers for generating steam, or heating water or other fluids, for useful purposes. September 24; six months to specify.

William Samuel Henson, of Chard, Somerset, machinist, for certain improvements in certain machinery used for making bobbin-net lace, for the purpose, by which improvements, of making certain kinds of ornamented net or lace with such machinery. October 1; six months.

Edwin Hoare, of Stonehouse, Gloucester, clothier, for a method of preventing the darkness of colour which frequently occurs near the lists as compared with the colour of the middle of woollen cloths, in the process of heating them in water or by steam on rollers. October 1; six months.

James Bullough, of Blackburn, Lancaster, mechanic, for certain improvements in hand-looms and power-looms. October 1; six months.

Charles Pierre Devaux, of Fenchurch-street, London, merchant, for certain improvements in smelting iron, stone, or iron ore; being a communication from a foreigner residing abroad. October 8; six months.

Apelles Howard, of Stockport, Chester, cotton-spinner, and John Scattergood, of Manchester, machine-broker, for their invention of improvements in looms for weaving, whether worked by hand or other power. October 8; six months.

Thomas Jevons, of Liverpool, merchant, for certain improved machinery to be used in manufacturing bar or wrought iron into shoes for horses, and also into shapes for other purposes; being a communication from a foreigner residing abroad. October 8; six months.

Robert Jupe, of New Bond-street, Hanover-square, upholsterer, for improvements in ornamental dessert, flower, and other stands. October 9; six months.

John William Fraser, of Ludgate-hill, London, artist, for improvements in raising weights or substances from below to the surface of the water. October 15; six months.

John Bird, of Birmingham, gentleman, for an improved method of making and compounding printers' ink, paints, and other pigments. October 15; six months.

Samuel Draper, of Basford, Nottingham, for improvements in producing plain or ornamental weaving. October 15; six months.

David Mushet, of Coleford, Gloucester, ironmaster, for a certain improvement in the art of making or manufacturing bar iron or malleable iron. October 22; six months.

Samuel Colt, of Ludgate-hill, London, gentleman, for certain improvements applicable to fire arms. October 22; six months.

Richard Barber, of Leicester, cotton-winder, for an improvement in reels for reeling. October 22; six months.

Samuel Slocum, of New-road, St. Pancras, engineer, for improvements in machinery for making pins. October 22; six months.

John Dyer, of Mark-lane, London, merchant, for improvements in the materials used for fining or clarifying liquids; being a communication from a foreigner residing abroad. October 22; six months

William Patterson, of Dublin, gentleman, for an improvement in converting hides and skins into leather by the application of matter obtained from a material not hitherto used for that purpose. October 22; six months.

George Baxter, of Charterhouse-square, engraver, for improvements in producing coloured steel-plate, copper-plate, and other impressions. October 23; six months.

James Walton, of Sowerby-bridge, Halifax, York, frizer, for certain improvements for dressing, finishing, and setting the face on woollen or other cloths requiring such process. October 23; six months.

John Baring, of Bishopsgate-street, London, Esq., for an invention of a machine for combing or brushing wool, flax, and other fibrous materials, into teeth set in a cylinder, or otherwise, for the purpose of separating the longer from the shorter fibre; being a communication from a foreigner residing abroad. October 23; six months.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price 6*d*. Also, the volume complete, in boards, price 9*s*. 6*d*.

Errata in Mr. Steer's Opinion, 3d paragraph, line 4, dele "and." In next page (63), line 3, for "came" read "come;" and line 15, for "on" read "in."

☞ Patents taken out with economy and despatch; Specifications prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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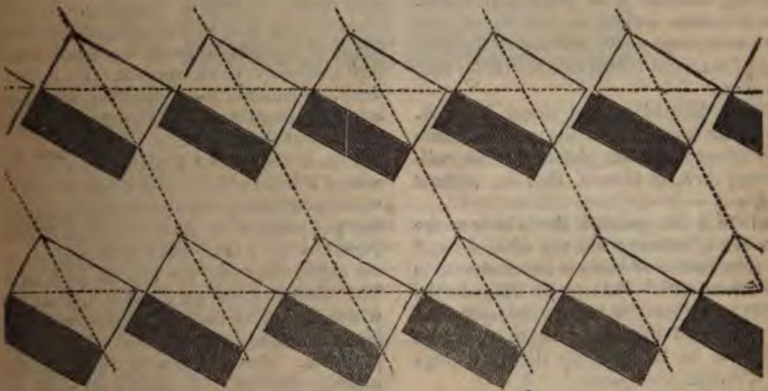
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 639. SATURDAY, NOVEMBER 7, 1835. Price 3*d*.

JOPLING'S IMPROVED RAILWAY PLATFORM.



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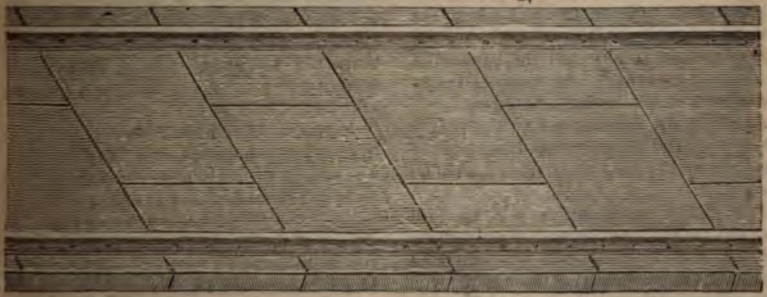

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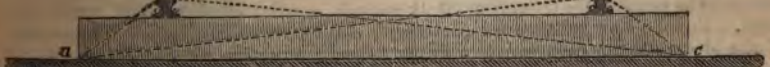

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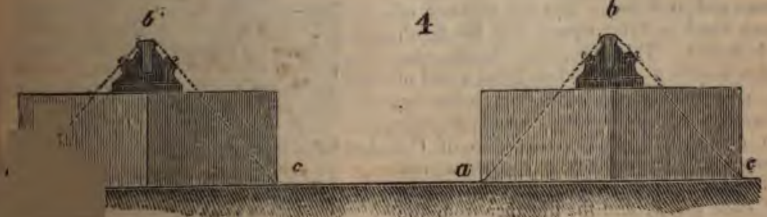


ON RAILWAY PLATFORMS. BY JOSEPH JOPLING, ESQ., ARCHITECT.

Sir,—Supposing the weight of the stone blocks, at the distance they are apart near Chalk Farm, to be sufficient for steadying the rails for such loads, and at such velocities as it is intended should pass along that railway, I have been considering whether it is possible to distribute the same weight in any other way more advantageously, and what description of material is best calculated for that purpose.

I have formed several plans, but venture first to submt to the consideration of engineers *a slate-platform, with rails screwed directly thereto, that is, without chairs.*

I take it for granted that the less the distance is between the top of a rail and the foundation or bed on which the stone is laid to which it is to be affixed, the better, so that the rail be of sufficient strength and the stone be of sufficient thickness to hold firmly the fastenings for the rail.

Also, that the nearer the points for supporting a rail are to each other, the less the vibration will be.

Again, that if any rail be supported throughout its length, the vertical vibration of it will be the least possible.

And further, that the nearer the points for fixing a rail to its stone support are to each other, the less strain there will be upon each.

The difference between the method adopted for the London and Birmingham Railway and the one now submitted to your readers, will appear obvious by the accompanying figures and the following description.

Fig. 1 is an isometrical representation of the stone blocks as they are placed for the chairs to support the rails, near Chalk Farm. The distance between the centres of the blocks under each rail is 5 feet; and the distance from the centre of one block to the centre of the next under the same rail is 3 feet. The top and bed of each block is 2 feet square, and the depth 12 inches. Therefore, each block contains 4 cubical feet, and each has a bed of 4 superficial feet; and, consequently, there are 8 cubical feet of stone, having in every yard in the direction of the length of each railway 8 superficial feet of bed. A chair is fixed over the centre of each block, and the distance from the top of the rail to the bottom or bed of the block is 18 inches. This will appear more evident by the transverse section, fig. 4, showing two of the blocks, and the position of the tops of the rails. The dotted lines *a b c*, from the top of each rail to the angle of each block on its bed, shows the greatest angle of resistance they have to lateral vibration. If the blocks were not placed diagonally, the angle of resistance would be much less, but probably more correct. It is, indeed, considered to be doubtful whether any advantage is obtained by the diagonal position of the blocks.

Fig. 2 represents a platform of slate, nearly 5 inches thick, and 6 feet 6 inches wide, containing the same cubical quantity per yard as the stone blocks at Chalk Farm. Fig. 3 is a transverse section of the same, showing the top of each rail. The dotted lines *a b c* show the angle which the top of each rail makes with the lateral extremities of the bed of the slate platform. The angles *a b c*, in fig. 3, are much greater than the angles *a b c*, fig. 4; besides, the latter is considerably too much. Therefore, the platform, it is considered, would hold the rails much steadier than the blocks at Chalk Farm; the weight per yard of each being the same, and both being bedded in the same way.

Fig. 5 is the section of a rail proposed to be affixed directly to the slate platform, by means of bolts and copper or brass nuts introduced into the slate. If there are eight of these bolts in each yard, the points of fastening to the platform would be four times as many as those to the stone blocks, and the strain upon each,

Fig. 5.

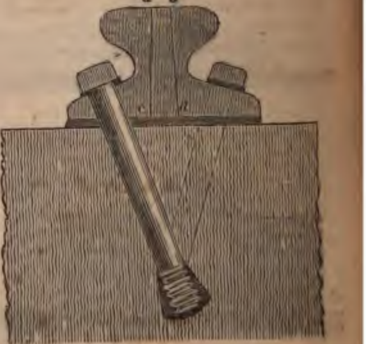
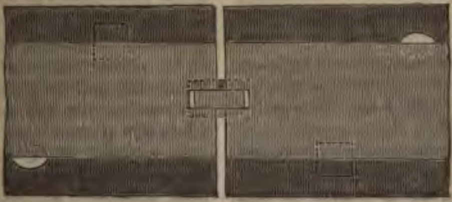


Fig. 6.



therefore, if the rail was not bedded, would only be ¼th; but as the rail is proposed to be bedded throughout on felt, and a leather collar under the head of each bolt, any jar or vibration the rail might have, it is considered, would scarcely be perceptible. The inner side of the rail, and the face of the slate under it, to be made quite fair. At each end of each piece of rail is to be a mortice, the vertical section of which is shown by the lines *abcd* on this figure.

Fig. 6 shows the plan of this rail where two lengths meet, with the mortice in each, and the wedge which keeps them fair, which, as well as the elliptical holes for the bolts, allows for expansion and contraction. Two bolt-heads are also shown.

This possibly may be sufficient for the present to draw attention to this subject; and I think I shall be able to show, that slate material is applicable for this purpose, and may be advantageously used for railways where there is great traffic, and where great speed is required.

I am, Sir,
Your obedient servant,
Joseph Jopling.

34, Somerset-street, Oct. 15, 1835.

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ON THE PROBABLE CONNEXION BETWEEN ELECTRICITY AND VEGETATION.

Sir,—The very handsome mention which is made of a manuscript of mine upon the subject of the connexion between electricity and vegetation, by Mr. Weekes, in the last volume of your periodical, p. 394, and the great obligations I am under to that gentleman for his very able and generous co-operation in pursuing the inquiry, encourage me in offering some particulars of our joint observations to the notice of your readers. In that manuscript I have endeavoured to bring together lights from various sources of information bearing upon the general subject, and combining to show the agency of electricity through the several stages of vegetation. I am sensible, however, that this very extensive subject requires much further investigation, while the mention of such facts as have fallen under my notice and that of Mr. W., in his kind exertions to forward my views, may be of use in drawing forth the remarks of some of your other correspondents.

Having learnt from the statements of the late Mr. Cavallo, and the more recent observations of Mr. Sturgeon, that our atmosphere is in a constant state of positive electricity with respect to the earth, and reflecting on its suitability to exert a continual action upon bodies so organized as those of plants, I was led to try the conducting agency of the pointed extremities of leaves; when it immediately appeared from every mode of trial that they are the most potent of conductors, not excepting the most acute metallic points. My proofs consisted simply in presenting them to the prime conductor of an electrical machine, or in passing the contents of a charged jar through them, when it appeared that the light entering or issuing from them was much more brilliant; that it would be seen upon the vegetable point to the exclusion of any light upon the metallic point when held equidistant, and that the former would continue to be illuminated at a much greater distance from the prime-conductor than the latter. The effects produced upon the electrometer affixed to the prime-conductor by the vegetable point, also much exceeded those produced by that of metal. When the human body was made a part of the circuit in discharging a jar through a vegetable point, the shock was barely perceptible, although the discharge was so complete as to leave hardly any residuum, whereas, a similar charge passed through a metallic point caused a very sensible shock.

Mr. Weekes on being made acquainted with several of the above facts, very obligingly entered on a course of experiments in illustration of the principle, by which he has shown with scientific exactness the superiority of vegetable points to those of metal, both in artificial electricity and in their application to the electricity of the atmosphere. As he has generously consigned to me the task of making known his experiments, I have great pleasure in doing so through the medium of your valuable Magazine, in his own words. After some apology for a previous delay, he writes me as follows:—"However, I find I have by no means had too much time for a fair and impartial examination of the subject, the interest of which to me has been such as to excite experiment far beyond my intentions at the outset. The final result in my mind is an entire conviction that your opinions are well founded, and have stood the test of the severest trials to which they could be subjected. The vast superiority of vegetable over metallic points in the drawing off and accumulating electric matter, is, I conceive, a subject of great interest and importance. A coated jar having 46 inches of metallic surface, was repeatedly discharged by the activity of a vegetable point in 4 min. 6 sec., while the same jar charged to the same degree required 11 min. 18 sec. to free it from its electric contents by means of a metallic point—the points in both cases being equidistant. I find, also, that Bennet's gold-leaf electroscope is powerfully affected by a charged jar at the distance of nearly 7 feet, when the brass cap of the instrument is furnished with a branch of the shrub called *Butcher's Broom*, and which I have found of great use in my experiments. The same delicate instrument, when mounted with pointed metallic wires, is not perceptibly affected until the charged jar approaches to within 2 feet of the cap."

In order to try the electric action of vegetable points immediately upon the atmosphere, Mr. Weekes placed "a large *street-lamp* in an inverted position, mounted with a brass cap, through which passed a stout wire with a brass knob" at its nether extremity, "and a pair of small pith balls attached" by threads "to the wire above the knob." Within the glass was placed "a portable stand with two metallic discs, one on each side of the wire, and rising to a level with the pith balls" To the summit of the wire he attached "a small branch of the butcher's broom." "This apparatus," he proceeds, "I have many weeks past had in almost daily use, nor can I express the pleasure it has afforded to myself and friends by its frequent indications of atmospheric electricity; for armed with *vegetable detectors*, it has shown symptoms of electricity by the passing of clouds at a great altitude, and under various other circumstances, in which electrometers with metallic points placed by its side gave no indication whatever. This appears to me so decided a proof of the superiority of vegetable conductors, that it admits of no contradiction."

The letter in which these accurate and decisive experiments are related, is dated the 8th of May 1828; and as they were recently made, they admirably illustrate the electrical state of plants and their action on the atmosphere in the spring season. This is no doubt the season of their greatest electric as well as vegetative activity, agreeably to which, in my first experiments made in the month of June, a blade of grass and a metallic point being mutually presented to the prime-conductor, the first continued to be illuminated till it had reached at least four times the distance, at which the latter ceased to exhibit any light, that is, at the distance of about 14 feet from the electrified body; whereas, in a similar experiment made in October, the grass-point affected the ball of the electrometer appended to the prime-conductor at a distance only of 19 inches, when a pointed metal of corresponding length, *i. e.* 5 inches, would affect it in an equal degree at the distance of $9\frac{5}{14}$ inches.

It cannot but be evident that very important consequences must flow from such extraordinary conducting energies in plants, more particularly as manifested through the acute extremities of their leaves, buds, and germs, in the spring season. When Mr. Loudon, in his "Encyclopedia of Gardening," suggests, p. 497, the propriety of erecting metallic points from the ground as the means of precipitating dews and rains, it is evident that he was not aware of the admirable arrangement that is made in the structure of plants for affecting these and other objects essential to vegetation, much more completely, as well as at infinitely less expense, than could be accomplished by means of any number or adaptation of metallic points. Mr. Weekes having represented me as the author of a theory entitled "Electro-Vegetation," and as I cannot deny having made such an "attempt" in manuscript, though sensible that it is indeed in its present state too theoretical and defective to meet the public eye, perhaps, however, I shall be excused in occupying the rest of this letter with a brief outline of its principles. I conceive, then, that the sun is the source, not only of light and heat, but of electricity; that electric and solar light are identical; or, rather, that light, heat, and electricity, are no other than so many effects or results from the operations of one common and inconceivably subtle fluid, of which the sun is the source or centre. That this fluid is essentially *luminous* and *repulsive*, appears evident from the following easy experiments:—take a thermometer separated from its scale, and by moistening the ball make it the outside conducting coating, the inside coating being furnished by the mercury. Apply sparks to the ball from an electrified body, the upper part of the tube being kept dry and held in the hand; in these circumstances a stream of electric light will be seen to shoot up from the mercury to the top of the tube, corresponding with every spark imparted to the outside coating;—the tube being a perfect vacuum, the fluid seen to rise in it must be essentially *luminous*; and, from its sudden expulsion from the mercury, with every spark applied to the outside coating, its particles must possess a strong mutual *repulsion*. It is remarkable. that in this experiment no increased heat appears to be generated, no rise being seen in the mercury, which remains *perfectly stationary; the reason of which I conceive is, that the quantity of the fluid, to which in this case we apply* the name of *caloric* contained in the mercury, is precisely the same before and after the application of electricity to the external coating,—every spark imparted to the outside being attended with precisely the same quantity ejected from within, and as this probably issues from the *glass*, it produces no alteration in the quantity of this expansive principle contained in the *mercury*. Now if we admit that the property of exciting the sensation of light in the optic nerve by direct rays issuing from luminous objects, and striking upon the retina, and that of a mutual repulsion between its particles, and of attraction for those of gravitating matter, are common to the electric fluid and to that which issues from the sun, we shall, I conceive, go far towards the admission of their identity; and if we allow, as a necessary consequence of the mutual repulsion of its particles, and of its attraction for gravitating matter, that it is the cause of the expansion or separation of the particles of the latter by which bodies become enlarged and attenuated; or, in cases of much resistance between the attractive and repulsive forces, that an agitation is produced in bodies which increases their temperature, or causes the sensation of *heat* to our nervous system, it will follow that the effects ascribed to caloric are only those particular results produced by one and the same *solar* or *electric* fluid.

We have seen from the above experiment that the same fluid that produces electricity, produces *light* and *repulsion*; and I need not remind your readers that the intensest *heat* and the *expansion* of the most solid and ponderous substances into their fluid and even gaseous states, are effected by its operations, whether accumulated in the natural artillery of the heavens—in the volcanic bowels of the earth—or concentrated in the artificial arrangements of a voltaic battery. Perhaps the principal difficulties attending the hypothesis of the identity of the electric and the solar fluid, arise from the considerations that electric phenomena are but seldom experienced to any great extent in the system of nature, and that accumulations of caloric and accumulations of electric matter are rarely attended with similar phenomena. In answer to the general objection, it may be observed that, as sensible electrical effects are comparatively seldom and to a very limited extent conducive to the harmony and useful operations of nature, and if suffered to exceed certain limits, would prove extremely injurious and destructive; so there are various admirable arrangements in the system by which such effects are obviated, and accumulations of the fluid, which would otherwise have caused much injury, are converted into blessings of great magnitude. But in order to a clear understanding of the means by which the injurious effects of electricity are obviated, it is requisite to form distinct ideas of the nature and causes of electrical phenomena in general, particularly as distinguished from those ascribed to the matter of heat or caloric. To me it appears that electricity is produced by that fluid acting in a free or uncombined state between bodies, which, when entering into their substance and forming a chemical union with their particles, produces the phenomena of heat and expansion. We rub gently a yielding substance which easily admits the flow of the fluid to or from its particles, or over its surface, against a hard substance which has the opposite property of retaining it upon its surface, or else of parting with a portion of it, without the property of allowing it to flow freely through and between its particles. The result is, that a portion of the fluid being thus added to or taken from the latter substance, which we term the *electric*, an effort is made by the fluid between that and the surrounding bodies to diffuse itself equably, or obtain its equilibrium. The sensible effects, attendant upon those movements of the fluid, we term *electrical.* We strike two hard substances, as a flint and steel, smartly against each other; heat and even fire is generated. In this case a change is effected, not only in the diffusion of the fluid, but in the states of the two substances, and, in some degree, of the contiguous atmosphere: so much of the fluid is now drawn from its former state, that it enters into new combinations, small portions of steel absorb it, and enter into the fluid or even gaseous state, while the rest, which has been *put in motion,* combines with the several *substances, and* increases their temperature *or expands* their volume; and *hence, there being* none left in a free or uncombined state, no electrical phenomena appear.

The fluid, which in an uncombined state, by means of artificial excitements, or in the form of lightning, produces electricity, emanates, I conceive, originally from the sun in that state; and that its direct rays either produce electric or galvanic effects; or, by entering into combination with air, water, or oxygen, obtained by the decomposition of carbonic acid, and, perhaps, from the leaves of plants, or being absorbed into the substance of our globe, are neutralized. The air being an electric, a portion of the fluid floats in an uncombined state upon it, which it would do in much greater quantities, more especially in the higher regions, where there is little gravitating matter with which it can combine, were it not continually imbibed by the sap and juices of plants. Their solid framework, consisting of non-conducting matter, and forming trunks pierced with an infinitude of capillary tubes, furnishes an admirable passage for the rise of the sap, and for the action of the positive electricity of the atmosphere, in drawing it upwards and toward all the acute extremities of the leaves. The electric matter being thus introduced, is enabled to operate upon all the vital functions of the plants, while its superabundance being transmitted down to the fibrous extremities of the roots, either causes them to imbibe new moisture, or is conveyed by it into the earth, thus maintaining that near approach to an equilibrium on which the general harmony and tranquillity of nature depends.

If the identity of the electric fluid with that which issues from the sun be admitted, a source is assigned by which, according to the testimonies of those electricians who have been in the habit of making experiments on the electricity of the atmosphere, it is preserved in a constant positive state with respect to the earth, and that notwithstanding the immense infinitude of potent conductors which shoot up from its bosom. If it be admitted that plants have their peculiar construction, and are furnished with their conducting points, with the accompanying sap and juices, for the twofold purpose of causing or promoting their vegetation, and of averting dangerous accumulations of electric matter in the atmosphere, the final and efficient causes of their structure and operations, to a certain extent, will appear. It has been observed by that excellent lecturer in galvanism and other branches of natural philosophy, Mr. Sturgeon, that the rotary motion of our globe, and of the other planetary bodies, receives illustration from the action of a galvanic current on bodies capable of receiving its influence placed at right angles to it; and if we allow that the earth actually receives such an influence from the sun, and is thus perpetually whirled round with its immense conducting apparatus for the purpose of imparting a vegetating principle to the system of plants, at the same time that light and warmth are conveyed to the whole creation, while all injurious effects from the effusion of so much electric matter are averted by the near approach to an equilibrium which they constantly maintain, a concurrence of useful causes and effects in carrying forward the operations of nature and maintaining its order and harmony will appear, which seems to reflect credibility on the general conclusion.

Would the limits of a letter admit of it, I might here introduce some experiments and facts tending to show not only the general influence of electricity in promoting the growth of plants, but that this effect is principally owing to the *positive* electricity of the atmosphere in regard to the soil. But experiments upon the relation between electricity and vegetation require to be repeated and extended in order to show the full operation of the principle. Mr. Weekes has favoured me with some communications of experiments of this description, which he has made both by an electrical machine and by galvanism, all of which, he acquaints me, have conduced to show the advancement of vegetation by electric influence. He has also directed my attention to an experiment, recorded some time since in the *Atlas* newspaper, showing the "power of spines in modifying the electric relation of the atmosphere and the earth, and in effecting the progress of vegetation." It is a very curious and decisive experiment, as illustrative of both these results. It perhaps remains to be determined how far, and by what more *economical* means than *have hitherto been discovered*, art *may be applied in forwarding* and *increasing the growth of plants*. A practitioner in medical electricity in this town assured me of some effects produced on plants kept in the room in which his powerful machine was daily in frequent action, of a nature and degree so extraordinary as would indicate the most important results, from keeping up a continual disparity between the positive electricity of the atmosphere and the negative electricity of the soil. If his representations were correct, and, from his known probity, I have every reason to confide in the general fidelity of statements which were of a most obvious description, the suggestion of Mr. J. Williams ("Climate of Great Britain," p. 348), for erecting "large electrical machines, to be driven by wind, over the general face of the country," might, at suitable seasons, promote even a more important object than that which he contemplated, viz. the general, more rapid, and more luxuriant advancement of vegetation, more particularly in those first stages in which electricity appears to operate with the greatest efficacy.

Should I succeed by the above sketch in conveying to yourself and your readers an idea of the leading principles which I conceive to be deducible from the facts of the extraordinary conducting virtues of plants, the constant positive electricity of the atmosphere, notwithstanding immense portions of the fluid, must be perpetually absorbed through their acute extremities; the many circumstances of analogy between the electric and solar fluids, rendering it probable that they are identical; and the known, but not sufficiently investigated, power of electricity in promoting vegetation—my design will be answered, and, whether it be approved or not, the facts, particularly those so satisfactorily shown by the well-devised and accurately-executed experiments of Mr. Weekes, cannot but afford considerable interest to your readers.

I am, Sir, yours respectfully,

T. PINE.

Maidstone, Oct. 1835.

P. S.—Allow me to add, that I have found it impossible in the above sketch to touch upon any thing more than what I conceive to be the general cause, and the introductory process of vegetation. It has, however, been my aim to trace the operations of electricity upon the successive processes through the medium of air and water, and by the direct rays of the sun; and to show how by all these processes plants operate beneficially to the animal creation. But as it is my wish to build on *facts*, resting as little as possible on *theory*, it has been my endeavour during this fine summer to acquire knowledge by actual observation and experiment; and should this communication meet your acceptance, I may be induced to renew the correspondence, particularly by stating some facts which I have recently witnessed.

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ON ROTARY STEAM-ENGINES, AND AVERY'S IN PARTICULAR.

Sir,—I beg leave to offer a few historical and physical remarks on the rotary-engine of Mr. Avery, described in your Magazine of Oct. 24, which I consider to be neither original or efficacious. The principle was first developed and applied by Hero, 130 years before the Christian era, who was the first individual on record that applied the force of steam to any purpose whatever; and the principle on which he applied it is precisely the same as that made use of by Mr. Avery. At the commencement of the 17th century, Giovanni Branca published an account of an engine on the same principle as Hero's, only differently modified; and in 1791, Mr. James Saddler, of Oxford, obtained a patent for a rotative-engine, which so closely resembles Mr. Avery's, not only in principle but in form, that Mr. Avery's can only be called a slight modification of it. After Saddler's patent some large engineers at Manchester took out one for an engine on the same principle, but abandoned it; and next in order to these may be placed Mr. Avery, as far as regards the application of this principle to steam-engines. To water-mills it is well known to have been applied long ago by Barker; a machine of the same construction is made use of by the cotton-weavers for stirring up their paste; and we may now see, in walking along the streets, the same principle applied to the revolving gas-lights of some of the gin-shops. I am by no means ridiculing the principle, nor do I mean to say that it cannot be usefully applied to some purposes, but that to steam-engines it never has yet; nor has Mr. Avery, in my opinion, succeeded better than his predeces[redacted] and I will now show where in one instance his attempt is a failure.

Mr. Minor, in his *Railroad Journal*, states, in speaking of the 6-horse engine with 18-inch arms, that "the two apertures at the end of the arms are equal to the eighth part of a superficial inch; and under a pressure of 80lbs. to the square inch, will balance a weight of 10lbs." I conclude, therefore, that the engine was then worked with steam of that pressure, viz. 80lbs. per square inch; and if so, the quantity of fuel consumed must be enormous, as it would require 16 cubic feet of water to be evaporated to work such an engine for one hour; which may be seen as follows:—As the surfaces of the two orifices at the ends of the arms taken together form the eighth of a superficial inch, therefore a cubic foot of steam in passing through such an orifice would form 1,152 feet run. Now, taking the pressure of the steam above the atmosphere at 73lbs. per square inch (which is giving Mr. Avery some advantage), a cubic foot of water will form 320 cubic feet of steam of that density; then multiplying this by 1,152, we get 368,640, the length in feet run of steam formed out of 1 cubic foot of water. Again, steam at that pressure travels into the air at the rate of 1,674 feet per second, and if we divide 368,640 by this, we get 220, the number of seconds a cubic foot of water converted into steam, under a pressure of 73lbs. per square inch, will take to travel through an orifice the area of which is the eighth of a superficial inch. And if 1 cubic foot will thus be consumed in 220 seconds, in like manner 16 feet will be consumed in 1 hour. If an engine is worked expansively with steam of that density in conjunction with a condenser, it will perform nearly 30-horse power with that consumption of water; but, according to the general calculation, that 1 cubic foot of water converted into steam should, at the lowest estimate, do the work of 1 horse for 1 hour, this 6-horse engine of Mr. Avery's ought to do the work of 16 horses. It is quite ridiculous to imagine, for a moment, that it ever can do this; and it is beyond my comprehension to see what advantage he can show to compensate for such a frightful waste of fuel.

I am, Sir, yours, &c.

ANTI-AVERY.

Oct. 30, 1835.

THE SHIP-SINKING SYSTEM.

Sir,—In further exposure of the ship-sinking system, I beg to state that, in March last, I attended a public meeting of merchant-ship owners and ship-builders, in Leith, at which it was moved and unanimously adopted, " That this Meeting, having fully considered the Rules for classification adopted in June last by the ' Provisional Committee' for the Regulation of Lloyd's Register of British and Foreign Ships, is of opinion, that they have not been adopted on any theoretical or practical knowledge of the strength or durability of the particular kinds of timber therein mentioned, but are founded on prejudice, or on information obtained from interested parties, and are for the benefit of the few to the evident injury of the many;" and, "this Meeting strongly recommends a heavier scantling of timber in the bottom." Which Resolutions were directed to be, and were, forwarded to the Society, accompanied by a firm, but respectful remonstrance for redress, and which remonstrance has been, as was to be expected, treated with the most superlative contempt. Here, then, we have a self-elected and irresponsible body of men—irresponsible in the very worst sense of the word, and acting solely for their own interests—enacting rules of classification, in direct prejudice of the public interests, and in direct opposition to the recorded sentiments of merchants, ship-owners, and ship-builders, and refusing redress to all these parties. Surely this system cannot continue much longer. Nine petitions were presented to the House of Commons last Session on the subject; and Mr. Buckingham has given notice on the books of a motion for next Session for a Committee to be appointed to inquire into the causes of the many shipwrecks of recent times, in order to ascertain how far they are occasioned by defective building and equipment, and defective management—and if so, whether the insurance system fosters this, and whether the evil may not be remedied? As, however, the interested opposition is so powerful, that there is reason to fear the Committee may be refused, it is to be hoped your readers, and the public in general, will pour in petitions from all quarters for inquiry, and for a *stop to be put—and it is easy to do so—to the practice of* " thousands of the best and bravest of our countrymen, and millions of property, being every year *systematically sacrificed*, in order that Lloyd's may flourish."

Your publishing these letters will, I hope, help to draw public attention to an evil so much to be depreciated; so easy to be remedied, as appears by facts which cannot be overthrown; and so much at variance with the ordinary dictates of humanity, and against the best interests of the nation. The evil, since it is directly productive of murder, is more clamant than the slave trade, now happily, so far as Great Britain is concerned, extinct.

I have the honour to be, Sir,
Your most obedient servant,
JAS. BALLINGALL, Naval Architect.

P. S.—I may take this opportunity of mentioning that the inner casing of the timbers (technically, the ceiling and limber-boards), of the Kirkcaldy smacks, Enterprise and Fifeshire, being made water-tight, and consequently to resist the admission of water from the outside, Lloyd's Register Society refuse to publish this fact in their Register-book, although application has been made to them for that purpose, knowing well how cheap and easily all merchant-vessels might be secured in the same way, and how very much it conduces to *safety*, the very thing, alas! which the Society *does not want*, and will resist to the uttermost.—J. B.

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SELECT COMMITTEE OF THE HOUSE OF COMMONS ON ARTS AND MANUFACTURES.

MINUTES OF EVIDENCE.

Mr. John Jobson Smith, of the firm of Steward, Smith, and Company, Iron-Founders, Sheffield, examined:—

What branch of manufacture do you particularly pursue?—Iron foundry, applied to ornaments.

Have you occasion to have models made to a great extent?—We expend about 1,500*l.* a year in the production of models of this kind for stoves and fenders alone.

[*The Witness produced a model of a stove-front.*]

Are your models, some of them, very beautiful?—They are very beautiful.

Has Sir Francis Chantrey expressed any opinion upon them?—Sir Francis Chantrey has seen some of them, which he said were the finest specimens of iron manufacture which he had seen in the kingdom.

In those works of art, how far is the inventor protected?—There is no protection at all; we have sent out such a thing as that on Monday morning, and it has been to Manchester, back again to Sheffield, and copied and returned to Manchester before Saturday night. The model which I am now speaking of cost us 50*l*. for men's labour.

Is the copy as good as your original work?—It is not; but they sell them so much cheaper, because they pay nothing for the production.

This of course is great injustice, and serious loss to the persons that invent the designs?—It is so great a loss, that we shall give up continuing it; I suppose that more than one-half of the patterns for stove-grates and fenders used in England have originated with us, but the piracy has come to such an extent, that unless there is some protection we must give it up altogether.

What would you suggest as a protection?—I should suggest some place, such as the National Gallery or Somerset House, where those things should be registered and some mark put upon it, such as the royal cipher or crown, denoting the registry, and a protection given for a certain time, three years perhaps.

Are you aware of the system by which patterns are protected in France?—I am not aware.

In the manufacturing towns of France there is a body consisting of one-half workmen and one-half masters, and to them the preservation of the patterns is confided by the law; the pattern is examined by this body, whose knowledge of the manufacture is sufficient to ascertain that it is original; the right of the presenter of it is recorded, with a given date, a small sum is paid for a protection for a certain number of years, and that record and the preservation of the pattern which is deposited in the hands of this body, enables him at once to enter legal proceedings against any pirater of the patent; do you think any such system of protection could be brought to bear in England, or can you suggest any better system of protection than that?—I should almost fancy that it would be impracticable in this country, because there is not such a location of the casting of iron.

Do you think a central board would answer the purpose?—I should think the object might be effected by a central board, where an actual cast of the original model might be deposited and registered, and left there a certain time for examination as to its originality, and the fact of its being registered might be proof of its originality after a certain time.

Would not the great difficulty be, that the persons who purloined patterns are ordinarily very inferior men, who could hardly repay the damage they have done?—It is not the case in articles of this kind, because there must be a considerable capital invested in the manufacture to produce it.

You think if you could verify the fact of your being the inventor, there would not be much difficulty in inflicting the penalty?—I think not.

You think it would not be worth the while of the inventor to go to the trouble and expense of registering unless the invention was worth protection?—No.

What are the class of artists that you employ for the production of patterns?—Some artists in London have been employed to make patterns for this description of goods. The young man that made this which I have produced has had no education in the art; he has studied from nature altogether, and this is a specimen of his production; he has risen so as to have the reputation of being the first in the trade.

Is he a person of considerable natural talent?—So much so that we have given him a share in the business on account of his natural talent.

Are those models drawn upon paper?—Yes; and if we were to confine ourselves to publishing them on paper, the law would give us a title to protection for them, but as soon as we bring them out in the form of a manufactured article we lose all right and title.

Are there several artists in Sheffield capable of producing such models as these?—There are several.

Have they increased of late years?—No.

Do they get tolerable wages?—They do not get very good wages, because the manufacturers in the neighbourhood so depend upon piracy, that they do not employ them; but if protection were afforded them, each manufacturer would be forced to employ an artist.

You think that if art were better protected in this country, there would be a greater demand for beautiful designs?—There would, because the general taste is so much better than it was, that very superior things are now in demand.

To what do you attribute the improvement in the public taste?—I have sometimes attributed it to the fact of there being so many fine models in plaster for the external and internal decorations of rooms, by which means they have become better spread.

Do not you think that the opening of our intercourse with the continent has led to a great improvement in the national taste?—

It has. French ornaments and French style have become introduced into this country, and become ingrafted into our own style.

Have you been able, notwithstanding the heavy duties upon this species of article, to export any to France?—No; we can send none to France; there have been some smuggled to France.

Do you think that the foreign models are superior or inferior to the English?—In this branch of manufacture I think they are inferior.

Are you aware that grates are not used in France?—They are used in France, I believe; they are porcelain grates very generally.

Are there persons employed at Sheffield to form those designs on paper?—No.

Have you attended to fenders as well as grates?—Yes.

Are the artists employed at Sheffield generally uneducated, or do they undergo some previous education in art?—They have had no education at all; it is a few men of natural talent, who have been accidentally directed to drawing very early, who have followed it up in this way.

Do you know any place in this country where a young man could obtain such knowledge?—No.

Have you a Mechanics' Institution at Sheffield?—We have.

Do not they instruct the young men gratuitously in design?—They have got several works of design, but there is no instruction given; those works however have been of great service.

Do you think it would be a good thing to extend the means of instruction in design among the people?—Certainly.

And especially to open collections of the best specimens?—Yes.

Have you often heard among artists a wish expressed that the knowledge of art should become more accessible to them?—Yes.

Do you know any class of persons in this country who are capable of teaching that kind of art to which you allude?—I am not aware that there are any except at very great expense.

Have the parties who draw those patterns been instructed at all in drawing?—Not at all.

And the state of the law is such that there is little encouragement to artists?—A capitalist will not purchase the higher order of talent, because no sooner does he produce it than it is stolen from him.

What can an artist obtain per week by devoting his time to the production of models in Sheffield?—About 3*l.* or 4*l.* if he is a clever man.

It is then the best paid labour?—It is.

How many artists do you suppose in Sheffield are solely employed in producing models?—Not above four.

Have they been all successful?—One of them has not been very successful.

Do not you think the public taste is so much improved that encouragement would be found for the production of articles more and more beautiful?—We find that we cannot produce articles too expensive for the public taste of the present day. Could we employ artists of a higher character, I am satisfied that the public would buy whatever was produced.

You think that cost would be no barrier to the sale of beautiful articles of art?—No; I should not myself hesitate in expending 200*l.* or 300*l.* in the production of a model for a grate to-morrow, if I had protection for it; but now it is certain that every thing worth pirating is pirated in three months; many things that are very good are pirated in fourteen days after the time of their production.

As the taste is perpetually varying, how long would you conceive a sufficient protection to a pattern?—I think three years would be the least. The custom of the manufacturers of those things is to visit their correspondents once in six months, and it frequently happens that there is some reason for not having a new thing at the time, and it is frequently a twelvemonth before a pattern comes fairly before the public. I think we should have a fair protection for three years.

Unless you give rather a long period to the protection of a design, is not the effect of it to allow only a man of large capital to reap the advantage from the protection, because he only can put out a sufficient quantity of the pattern to remunerate himself?—Yes; every person to produce things of this kind must keep an extensive establishment about him. Besides the payment of the designer and the modeller, there must be workmen who get high wages after they have been designed and modelled.

Would the amount of capital employed in your business depend upon whether you had a protection for two years or three years?—No.

Does what you state apply, not only to your own line, but to all other lines in Sheffield?—Yes.

And more especially to steel and plated goods?—All the articles of plated goods that are stamped.

Have you conversed with persons whom you think most capable of judging of the propriety of legislative measures to protect such inventions?—I have.

Is the plan you have suggested of a Central Board the result of your inquiries among them?—It was my own opinion. I have not spoken to others respecting the details of th protection, but only generally; and I have the authority of Sir Francis Chantrey to say, that he decidedly coincides in my views, and he thinks that it is most desirable that something should be done for the protection of arts of design.

Do you consider that the suggestion you have made would be practicable without interfering with the general convenience of manufacturers throughout the kingdom?—There is a certain class of manufacturers whose convenience it would most materially interfere with, in the same way that the police interfere with the practices of certain men.

You say that you think you ought to have it for three years; by what means could the numerous manufacturers of similar articles throughout the kingdom know when the period had expired?—I would say, that upon each article registered there should be a royal cipher and a crown cast, and a penalty should be attached to the casting that without a register, and there should be a penalty attached to casting it after the period of protection had expired, so that the public would know what articles were under the protection.

Suppose you put a crown upon an article on the 27th of July, how could a man that makes similar articles in Scotland, upon seeing one of those grates, discover from it whether your protection commenced in 1835 or 1837?—There would be the central register here, which should be open to the public, and he might obtain a drawing of any particular design by applying to the Register-office, and if it was worth his while to make it, it would certainly be worth his while to apply for a drawing of it; but if it was necessary, the date might be put upon most things; upon a large article it might be done with the greatest facility, but there are many things so small, that we could hardly put the date upon it; for instance, an ornament that would have to be cast in the sand.

Do not you think, that if there was not the facility of copying that now exists, any new invention would be more slowly promulgated through the people?—We visit every town in England twice a year, and therefore the whole country has an opportunity of having those things if they please. The fact is, that instead of each house making designs for itself, or each employing an artist competing with the artist of another house, there are not above two or three now producing models for the whole of the kingdom.

Do you think it would be possible to effect the object in this way, by allowing the inventor to permit other persons to use the invention upon payment of a certain sum to himself?—I do not think that could be done. I think men would be more disposed to produce their own, than to live upon the reputation of their neighbours.

Is not there great difficulty in discovering what is a distinct pattern, and what is only a variation from a previous pattern?—There is the greatest difficulty there; but I think persons would not be willing to produce a pattern that was doubtful as to its originality.

Do not a great number of ornaments consist of a combination of old materials, and is it not likely that any other individual might combine those materials in a manner so similar as to make it difficult to know whether he had the object of piracy in view, or whether the similarity was not casual?—There would be so much of the particular mind and style of the artist, as to fairly constitute an original.

Is not this particular grate now before the Committee a combination of common ornament?—There has never been any thing approaching this before.

Unless it were so distinct, would it be worth your while to pay so much to your designer for it?—Certainly not.

Mr. John Martin examined:

You are well known as the painter of many eminent works; in your early professional education, had you occasion to acquire a knowledge of those manufactures that depend somewhat on the arts?—Yes.

State what branch you became acquainted with?—That of coach-painting.

What information can you give us on this portion of the subject?—I fear very little: only with regard to art there is great deficiency in drawing and colouring, as we know by the works on coach panels, but there is capability of a great deal of improvement, with the assistance of schools, or rather museums.

It would give, you think, a greater development to art?—Supposing at museums, such as the British Museum, there were professors capable of instructing; I mean for the study of the human figure, landscape painting, architecture, and every other useful branch.

Have you pursued any other branch of manufacture connected with the arts?—China-painting; when I first came to London it was just going out of fashion, for it depends on fashion when not sufficiently advanced by the assistance of art.

What do you think of the state of art in regard to china-painting?—It is very low indeed, in consequence of the deficient knowledge in drawing and the arts in general; I believe it has gone down considerably since Mr. Muss and Mr. Marsh (who was a very eminent flower-painter at that time) left it.

Do you suppose that instruction is required for the artist in china-painting?—Yes, a knowledge of drawing is decidedly necessary; it was their knowledge of drawing, &c. that made Mr. Muss and Mr. Marsh so superior to others; but owing to the decline of china-painting they were compelled to leave it; and it has since entirely gone to the ground.

When you speak of painting in china, do you include in that enamel-painting? —Painting on china is a sort of enamel-painting, but that which is generally understood by enamel-painting is the style in which Mr. Bone and Mr. Muss attained such pre-eminence; that it is strange that so splendid and truly national a collection as Mr. Bone's "Eminent Characters of the Elizabethan Age," should not long ere this have been lodged in the British Museum or National Gallery.

Have you turned your attention to the difference or the relative state of china-painting in France and England?—I have seen some French painting on china, and upon the whole I think the finish is much higher.

Do they draw better?—Yes; the French are better draughtsmen, almost in every thing; I suppose they have a better opportunity of learning; besides it is patronised by Government.

You think for china-painting that instruction in correctness of design is very much wanted by our artists?—Yes.

For instance, you mean in anatomy, perspective and proportion?—Yes, every branch of the art might be obtained in a museum where every one is permitted to go; but there are no professors in the British Museum, and the students can only learn by seeing others draw on the spot from things which are worth drawing; the Elgin marbles for instance.

Do you not think it desirable that an artist should possess a knowledge of anatomy?—Certainly, for the drawing of the human figure or animals.

Might it not be desirable to give them opportunities of understanding *ab initio*, beginning with the skeleton, and going on to the whole proportion?—Yes.

And the study of the muscles?—Yes, and proportion, which has never been attended to.

Would a young man learn all these, according to this division of labour in the art, merely by a museum?—I think so, by proper masters.

You would have masters?—Yes; masters are necessary to give the proper direction to the pursuits of the student; but one master might teach two or three branches of the art, as follows: one master should teach anatomy and proportion; another, architecture, isometrical perspective and perspective; a third, landscape and nature in general; indeed, professors might be appointed to teach every branch of art, science, and literature; as in the British Museum every thing requisite is on the spot, and few alterations in the establishment would be needed. The National Gallery, and the National Gallery of Practical Science, might become branches of the British Museum. The grand object of a student should be to divide his time so as not to lose any, and not to give too much study to one pursuit or branch of the art. I firmly believe that the arts are useful to every branch of manufacture in the land; there is hardly a branch one can name that is not useful, from the lowest to the highest state of society; even to our legislators, drawing is useful, for they are not capable of judging of a plan without a knowledge of it; and they are consequently compelled to apply to practical men, and sometimes to dull-headed practical men, who are likewise often unacquainted with drawing, to have their opinion on any new principle in plans that may be laid before them.

Have you any other observations to offer as to china-painting?—No more.

You conceive, that were the artists instructed better in the principles of drawing, by improving the beauty of their productions, you would extend their sale?—Yes, and it would not depend too much on fashion as it did when it was merely a passing thing except that it would pass into other countries, and the beauty of design and workmanship would be admired in foreign countries, and be valuable in the commerce of that article.

At present, in china-painting, do we invent designs, or simply copy old ones already existing?—When I commenced, I invented my own designs, but that was peculiar perhaps to me; Mr. Muss and Mr. Marsh used occasionally to design their own.

At present do we invent as much, or copy more?—It has fallen so low, that what is done is not worthy of being called invention; the French are beating us hollow.

Independently of extending the sale of works of art, you would think you would confer on them a permanently intellectual interest, were the artists well instructed?—Yes; when we understand drawing, we cannot bear to look at a thing ill drawn; it affects the feelings in an uncomfortable manner.

Do you not think that the Wedgwood ware, which is made from the cheapest and commonest materials, by being made of beautiful forms and being covered by beautiful designs, has attained a rank it otherwise could not have obtained?—Yes, certainly; they are beautiful works of art, and though of the commonest materials, we are delighted with the forms. Painting will only interfere with the beauty of the form when it is very excellent; it is a rule in composition never to put an ugly object before a graceful one.

You mean that genuine beauty becomes permanent, and independent of fashion?—Yes, accidental circumstances can never affect real beauty; I have seen beautiful pieces of china in form disfigured by bad painting; in consequence of that, I have my china generally without any painting, as I like the form undisturbed; and though the other cost more, I would rather have given the larger price for the plain china, than for that which was painted, unless the painting was good.

Do you think china-painting might become an extensive means of developing designs?—Yes, it is perpetually before us; every day we see china; at all our meals the elegant and beautiful china is always before us; we are delighted with a piece of beautiful workmanship, and it might be rendered very cheap if there were a great number of clever draughtsmen as china-painters, but you could not find them now.

Few things come so constantly under the eye as china?—No, very few.

Can you give any information as to the state of glass-painting?—Yes, I was more occupied by glass-painting than any other branch before I became an artist.

Have the goodness to give the Committee such information as you have been induced to collect on the subject of glass-painting?—Glass-painting has fallen almost to the same level as china-painting; but it might be greatly superior now to what it was in ancient times. There is an ignorant opinion among people that the ancient art of glass-painting is completely lost; it is totally void of foundation, for we can carry it to a much higher pitch than the ancients, except in one particular colour, which is that of ruby, and we come very near to that. We can blend the colours and produce the effects of light and shadow, which they could not do, by harmonising and mixing the colours in such a way, and fixing by proper enamelling and burning them, that they shall afterwards become just as permanent as those of the ancients, with the additional advantage of throwing in superior art.

Do you think that the glass-painting artist wants instruction in correctness of design as much as the china-painter?—Yes, more, as it is a higher branch of art; but one of the greatest drawbacks of glass-painting, and the great cause of its being neglected, is this: it is so liable to be broken, that no person can venture to pay the artist sufficiently for his labour, on account of the thin and brittle material on which he is obliged to work.

You think there is a want of encouragement?—Yes, or else glass-painting must have surpassed all other branches of art in splendour, as it is capable of producing the most splendid and beautiful effects, far superior to oil-painting or water-colours; for by the transparency, we have the means of bringing in real light, and have the full scale of nature as to light and as to shadow, as well as to the richness of colour, which we have not in oil-painting nor in water-colour.

When you were employed painting on glass, did you find the Excise laws present any great obstacle to the improvement?—Yes, that was the greatest obstacle. We intended to make experiments on plate-glass; I did, and succeeded with it, but the expense of plate at that time, in consequence of the heavy duty, finally put an end to those experiments, as we could neither afford to purchase such expensive glass, nor to erect larger annealing-kilns, for if not properly annealed, the glass is liable to fly. I believe I was the only person who made experiments on plate-glass; they were supposed to be successful, only I could not afford to carry them on, for the reason before given. This is the principal cause of the fall of painting on glass, but if I could have made my experiments duty-free, I should have succeeded, for the plate-glass is so thick that it would be safe from being broken by ordinary means, and it has besides another advantage, that plates can be obtained sufficiently large to obviate the necessity for those bars which interrupt the present works.

Are the artists who pursue glass-painting now well educated in drawing?—No, the want of that knowledge has helped its decline; Mr. Hedgland, the architect, Mr. Hoadly and Mr. Oldfield, are, I believe, the principal glass-painters remaining.

At the present time you think the cause of the badness of execution is owing to the want of education in drawing?—Partly so; I should have painted some of my own subjects, as the effect produced on glass would be particularly adapted to them, if the experiments, &c. had been less expensive. I have always regretted the cost of the experiments, as works executed on plate-glass on a very large scale would have been most manificent in cathedrals or great public buildings; the knowledge and experience we had gained from our various experiments would have enabled us to produce grander works than have ever yet been seen in public buildings. I did not leave this branch of art without establishing a mode which has been, and will remain in use as long as glass-painting is an art.

Why did you discontinue it?—I could not get a sufficient price for a highly-finished work to pay for the hazard; I painted some very highly-finished paintings which were purchased by Lord Ennismore, who was very fond of glass-painting, and I finished Mr. Charles Muss's works, when he died in 1824.

After you left glass-painting you became historical painter and engraver, and have executed your own designs?—Yes.

Is there any protection for copyright in those original compositions?—Not the least; for the expense is so great, that even if we gain our action we sustain great loss, and can only recover so much as we can prove has been sold; and it is no easy matter to prove more than the sale of one or two prints, although we may know a thousand have been sold; we are therefore ruined if we go to law. I have in my own person experienced great losses from the system, as the French copies of my works are brought over from France and sold in every part of the country. I was told that various shops in Windsor had got my works lithographed and selling at very low prices, to my complete ruin; and if I am not protected by some new law, I shall be compelled entirely to leave that branch of the profession by which I live; for my pictures are so extensive and cost me so much labour that I cannot subsist by painting, as very few can pay me 1,000*l.* or 2,000*l.*, and I cannot execute them for less.

What is the principal defect; this expensiveness of the law?—Yes, in a great measure; it costs so much money to carry the law into execution, and as it is not exactly clear, we are not sure after all that we shall not be beaten, though our proofs are ever so good. The person may come forward with false witnesses, and swear that he did not sell.

But you have obtained an injunction?—No, I cannot get an injunction; I applied for one to prevent a person from exhibiting a copy of my work in a sort of diorama of Belshazzar's Feast, in Oxford-street, and that person contested it with me. This diorama was a most infamous piece of painting, and the public were given to understand that I was the painter; this was ruining my reputation, and at the same time taking that from me which ought to be my own, my copyright. I ought to have the power of demanding so much money for permission, but this copy was made not only without my leave, but my name given as the painter. I endeavoured to stop the exhibition by an injunction, but was referred to a jury.

Is there any remedy that presents itself to your mind for protection?—Yes; I think I could be protected with regard to the law of copyright of engravings, &c., and take this opportunity of showing how incorrect is any opinion that may prevail as to the sufficiency of the present protection; for the plagiarist is not only safe from prosecution on account of the expense of such prosecution outweighing all the advantages that can be derived from a verdict; but as in my own case, he even comes into the field with a cheaper production, supported by all the effect of the advertisements, and other expensive means of publicity that my own performances had led me to adopt. He not only robs me of my ideas, but establishes a lucrative trade on the effects of my pecuniary outlay; wherefore I have always thought, and I still think, that the copyright should remain in the person of the designer, so long as he lives, and of his heirs so long as they possess the works, the same as any other property, unless, of course, there be a distinct written agreement to the contrary. That it should be so is obvious, but there is not in fact any real protection to copyright, owing to the uncertain state of the law on the subject. Supposing, for example, that in the case of pirated copies of my engravings, I do by chance obtain a verdict from a jury, I can only recover the amount of what I can prove the defendant to have actually sold, which is my sole compensation for the thousands that are known to have been sold, but which it would be impossible to prove by evidence, since open book accounts of such transactions are never kept. Or take another case, of a picture being copied for a dioramic or other exhibition; suppose that on applying for the injunction, his Honour is not able to distinguish the difference between a picture of Belshazzar's Feast and a piece of lace, and leaves it for a jury to decide whether a diorama is to be considered a painting, or a copy coming under the meaning of the Act; all the satisfaction I obtain is heavy law expenses, with a certainty of an enormous increase if I hazard an action. The above cases are enough to prove that there is no efficient protection; but there are many other ways of infringing a copyright, one of which is, that any unprincipled person may copy an early and most imperfect work, and publish it as if just executed, although the publication of such a puerile attempt would never have been sanctioned by the artist from regard to his own reputation. I will venture to suggest a method of protection; a committee of gentlemen and artists might be appointed to sit at the museum about once in the fortnight or month; say in the following towns, namely, for England, London, Bath, Liverpool, Birmingham, Hull, and Newcastle-upon-Tyne; for Scotland, Edinburgh and Glasgow; and for Ireland, Dublin and Cork, for the purpose of receiving and registering impressions of original works, after which the copyright should be considered as fixed; and all false copies found in any part of the United Kingdom, after the copyright has been fixed, should be seized. We should, likewise, have the power of seizing all foreign copies as smuggled goods, and treating the possessors accordingly. Thus no print should be protected unless deposited at the museum, or whatever other place or places might be appointed; I think by that it would be put a stop to. I would have it at the British Museum, certainly; it would be desirable also to have them in each manufacturing town.

(*To be continued.*)

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NOTES AND NOTICES.

Portland Breakwater.—Objections have been hinted that the Portland Breakwater will endanger vessels when it blows hard at N. W., which appears extraordinary for the following reasons, viz. no sea can operate in conjunction with the wind in that direction, as the land from the north (or preventive station) towards the Ferry from whence the N. W. point lays, shelters it in a great degree, and the distance from that part of the coast to the Breakwater being only about two miles and a quarter, there is little run for the sea, and the Breakwater stops any swell of the sea from entering the Basin within it, and consequently the interior must be still water. In reference to this matter it is to be observed, that the Plymouth Breakwater, when the wind is from the S. W. to S. E., is situated nearly with respect to those winds as the Portland Breakwater should be with regard to the N. W. The Plymouth Breakwater breaks the sea on its entrance, so that there is only the force of the wind to contend with. Vessels in violent cases generally lower topmasts, &c., and make all snug. Vessels coming round Portland from the westward bound to Portland Roads, wind at S. to W., will clear the N E. point of the Breakwater with the wind on the beam, and cast anchor in smooth water, and with the wind at N. W. Vessels bound for Portland Roads from the westward will fetch the N. E. point of the Breakwater without tacking. Vessels will also have the advantage of bringing up under the lee, or S. E. side of the Breakwater, so that it is evident it would certainly create a safe anchorage for ships in all weathers, within the bosom of the Isle of Portland.—*Jersey Star.*

To Purify Foul Casks.—First wash the inside of the barrel with cold water till it is perfectly clean. Then for an eighteen-gallon cask mix two gallons of cold water with half a pint of chloride of lime, which may be purchased for twopence, which pour into the barrel, and shake it about for about a quarter of an hour, then turn it out, and again wash the cask with pure cold water. A strong smell of lime will arise for some time, but in two or three hours it will leave it entirely. No fear need be entertained that any taste or smell of lime will be given to the ale.

Manufacture of Salt.—At the Anderton works, near Northwich a new method of making salt has been discovered, and pans have been put up on a small scale to try the effect, which has proved so far most satisfactory. A fresh-water boiler is placed in the midst of the brine directly over the fire, the brine receiving at once the whole of the heat from the boiler and the fire; the overplus steam which is generated is applied to another pan, by this means a high temperature is obtained for 1,600 surface feet, which by the old mode would require 4 fires; immense expense in labour, and wear and tear, is *saved. Mr. William Garrod* is the inventor; he has taken out a patent. It is expected that more than 5 tons of salt will be made by one ton of coals; by the old method not more than 2½ or 3 can be produced from the same quantity of fuel.—*Mining Journal.*

The Macropona.—A very beautiful and extraordinary specimen of that curious fossil fish, the macropona, has lately been discovered in the chalk of the South Downs. It is nearly two feet long; the bones of the head are finely preserved, and are held together by pyrites; the latter have probably been produced by the evolution of sulphurated hydrogen during putrefaction, and the presence of oxide of iron in the surrounding mud; the stomach is also preserved. The lower jaw of a horse has lately been found in the rock near Rottingdean, embedded in the conglomerated shingle of the ancient beach, in the cliff.

We were present at an experimental trial at the Hereford Foundry, of a double-cylinder grinding-mill, of a construction entirely new to this part of the kingdom. The mill is intended for crushing fruit, bones, &c., is of great power, and very simple in its principle. The propelling power is steam, but horse power may easily be applied. Should the enterprising proprietor, Captain Radford, succeed in perfecting the machine, the economy which it will effect in horse and manual labour will render the mill a most valuable agent on every farm.—*Hereford Times.*

The Carlsruhe Gazette mentions a piece of mechanism which perfectly imitates the voice of a child, and produces distinctly every word with its proper modulation. The mechanism, it says, is very simple, consisting of sixteen levers answering to the sixteen simple sounds, moved by so many keys, like those of a harpsichord, so that these, properly touched, produce any articulate sounds required.

Flax-Spinning.—A letter from Lille says:—"A great establishment is now erecting in this city. It is intended for spinning flax by machinery. Thus the great problem is solved, for which the Emperor Napoleon offered a reward of a million of francs, and we shall now enter into competition with the English, who eagerly buy up all the flax of our country."—*Brussels Paper.*

Iver M'Iver's answer to Anti-Carper's challenge in our next; also Mr. Beale's reply to Mr. Barlow.

Communications received from Mr. H. Michel—G. F.—La Verité toute nue—W. C.—M. G., jun.—A Sufferer—Mr. H. Richards.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles Esq., C. E., is just published, price 6*d*. Also, the volume complete, in boards, price 9*s*. 6*d*.

☞ Patents taken out with economy and despatch; Specifications prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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JONES'S MAGIC LANTERN.

Fig. 1.

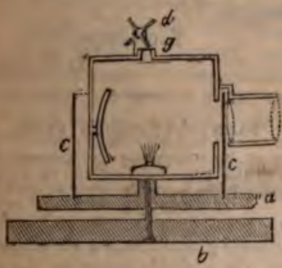
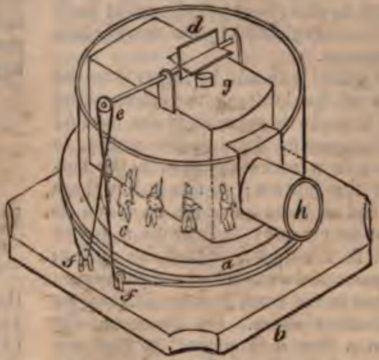
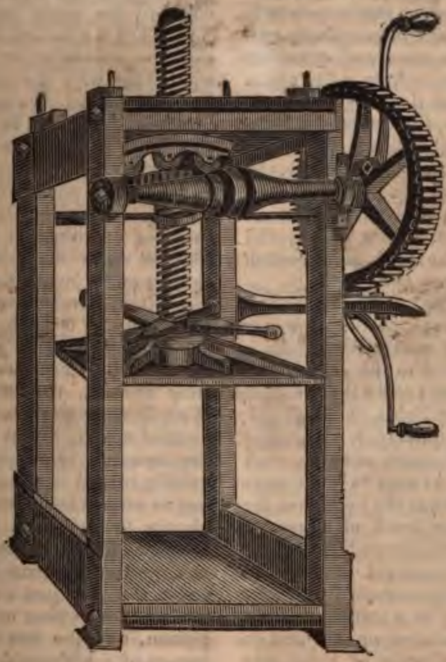


Fig. 2.



BARNES' STANDING PRESS



JONES'S IMPROVED MAGIC LANTERN WITH SELF-MOVING SLIDES.

(From the *Franklin Journal.*)

Sir,—I send you a description of an improvement in the magic lantern made by me in 1825; an account of which has not been published in any work. By a slight alteration the common form of lantern may be adapted. In the accompanying figures (front page) similar parts in each are explained by the same letters of reference.

The pulley *a* should be larger than the bottom of the lantern; the arbor round which it works is secured to the base *b;* and after passing through the pulley, is received in a socket fastened to the bottom of the lantern; on this pulley there is placed a band of glass, *c*, which is kept in its place by fitting into a groove turned in the upper side of the pulley; the figures to be exhibited are painted on the glass in the same manner as those on the common slides. On the top of the lantern a fan *d* is placed, so that the leaves on one side of the centre will be acted upon by the rarefied air passing up the chimney; at one end of the spindle of the fan is a small pulley, *e*, over which an endless cord passes, and connects it with the pulley *a;* the intermediate pulleys, *ff*, are for the purpose of changing the direction of the cord, so as to admit of its passing around *d.*

Now it is evident, that when the lamp in the lantern is lighted, and a current of heated air passes up the chimney, the fan will revolve, and the motion will be communicated to the band of glass on the pulley *a;* and that the figures will be represented on the screw in succession as they are painted on the glass.

In exhibiting, to give the greatest effect to the deception, have a hood placed over the lantern, and a cord leading from it over pulleys, fastened to the ceiling at a back part of the room; when the audience are seated and the lights extinguished, by raising the hood quickly, it will appear to those not in the secret to be the work of enchantment. As soon as the figures have all passed, lower the hood over the lantern, change the band of glass for another, and so on to the end.

The above arrangement admits of a more perfect action than the old plan; for instance, there may be a stationary slide, with a road, &c. painted on it; and on *the band of glass,* a troop of horse may be represented, which will have the appearance of travelling over the ground: the effect may be heightened by the under side of the pulley, near the periphery, being fluted in radii, by fixing a pin directly under the tube of the lantern; the pulley in passing over it will receive an undulating motion, which will be communicated to the figures on the glass. Fig. 1 is a longitudinal section taken through the centre. Fig. 2, a perspective view of the lantern and its appendages.

Yours respectfully,
A. C. JONES.

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BARNES' STANDING PRESS.

Report of the Committee on Science and the Arts of the Franklin Institute, to whom this Standing Press was referred for examination.

This press (see front-page) embraces the following combination of simple machines, viz. a single screw in the centre of a cast-iron frame, moving vertically through a nut or box in the upper part of the said frame, which box is supported when the press is not in use on a cross-plate below, and when in action is kept down by the upper head of the frame. To the box is attached a toothed-wheel of cast-iron, on the upper surface of which, continuous with the surface of the box itself, is placed a circuit of ellipsoidal friction-rollers, kept in their places by a flanch on a moveable ring of iron, and playing between the upper surface of the box and the under surface of the top-plate of the frame. By the arrangements thus far described, it will be perceived that the screw may rise and fall by revolving on its own axis, carrying with it the platten attached to its lower extremity by means of a knob or head of well-known application. The screw is made to revolve, by four arms fastened to the body thereof, just above the platten. With this arrangement the machine, in point of action, differs in no respect from the common screw-press, but may be quickly turned in either direction, involving no serious loss of time in bringing the platten to and from its work. When, however, the pressure becomes too intense to allow the workman longer to turn the screw, the arms just mentioned are made stationary by a plug or plugs set into the platten, and the box itself is turned by means of a horizontal tangent screw applied to the tangent-wheel already described. It is now that the friction-rollers come into play, preventing, to a considerable extent, the resistance which would otherwise proceed from the action of the box against the roller in the top block against which it plays. The axis of the screw has a winch of convenient length, by which it may be turned as long as it is thought practicable; and it also carries a toothed-wheel, which is capable of being acted on by a pinion of much smaller diameter, that may be thrown into gear at pleasure, and to which the winch may be then transferred. This third and last mode of giving motion to the press is only required when extreme pressure is to be communicated.

The Committee think the advantage of three rates of speed in this press will commend it to the attention of manufacturers, who have often found cause to complain of the loss of time involved by the common hydrostatic-press, with a single forcing-pump, and equally so by those screw-presses in which the whole range of motion was to be effected by a comparatively slow process.

As the inventor does not confine himself to any particular scale of dimensions, we have not deemed it necessary to make a statement of the calculation applicable to the press which we have examined, further than to remark, that it multiplies the force applied 10,000 times, and when operated on by a single man capable of applying sixty-six pounds, may, exclusive of friction, apply a pressure amounting to about 200 tons.

William Hamilton, Actuary.

June 11, 1835.

NOTES OF A TRAVELLER ON AMERICAN STEAM-NAVIGATION.

NO. III.

Mr. Editor,—In my former papers I promised to give you a general outline of the build, shape, trim, &c. of the Western steamers, which are all constructed for the navigation of smooth water. They are all intended to run on an "even keel," though few of them are entitled to that character, for their bottoms are generally flat. The bows are shaped rather bluff—in the best and last constructed, like the front of a duck, which appears to be the form now *most approved of.* The curves of the bow gradually lose themselves in right lines, which compose the bottom and sides, till about four-fifths the length, when they draw in for the run towards the stern. The run is moderate; its use more to give effect to the rudder than improve the sailing of the vessel. The wall-side secured with diagonal timbers, and a partition extending from stem to stern in the hold, rising from the kelson, also braced with diagonal timbers, give great stability to the hold, so that but little, if any, change of shape takes place when the boat is launched; though many boats have been "hogged" from want of braces of this kind, or some other. It is common to carry bridges or braces from stem to stern of the boats in various ways, particularly when they are sharp, on account of their great length, rendering a falling down of these parts almost certain. Besides the "midriff" spoken of above, as dividing the hold into the larboard and starboard, it is now common to run water-tight partitions across, so that the body of the steamer, like the Chinese junks, is composed of a number of distinct water-tight chambers. The plan is a very good one, though, like every thing else, it is subject to some objections, which are nothing compared to the immense security afforded by the arrangement. The snag-chamber in front is, or should be, empty; or may be used to hold lumber for the carpenter, who should be always well supplied with "stuff," particularly boards for the paddles, which are constantly injured by drift-logs, ice, and so forth.

The timbers for the deck are carried over the gunwale for a sufficient distance, so that when the deck is planked it extends a considerable distance abroad, forming a stage or balcony, called the "guard." The stauncheons for the cabins are quite independent of the ship's timbers, though they rise from the deck immediately over them. Indeed, it is customary to finish the deck and guard as if it was not intended to put a cabin or rather *hotel* upon it. The boat-builder finishes so far, and receives his money, delivering the vessel to the owner; or he gets a note or bond on delivering the hull up in this state. The fitter-up and carpenters next begin at the cabin, by mortising holes in the deck for the uprights, and planing the sheathing of the paddle-boxes. When they have advanced sufficiently, the engineer ships the fire-place on the deck, and gets in the boilers, which are set; the engine is next put up. The other jobs are dispatched in order. The cabin is fitted up, carpeted and furnished; the cuddy set to rights; and every thing arranged for the commencement of business. The builder is at all risks until he delivers the boat to the carpenters, when it may be considered as becoming the property of the owners, though they may have advanced money to the builder before. All the parties who have performed work in the boat, or furnished materials that are in her, have, if they choose to register their accounts, liens on her, which are equivalent to mortgages. They may advertise and sell her if their accounts are not paid, or sufficient security or satisfaction given them that their claims will be paid before the vessel makes her first trip. A steamer is always accountable for the debts of the captain and crew incurred on the account of the owners afterwards; so one may easily understand why these craft change owners so very often.

The gentlemen's cabin used to be placed in the lower or proper deck, and the ladies' above it, as in the Huntsman; but this is not the fashion in the largest boats of the present day. In these the lower deck is devoted to various uses, and the cabin extends from the bell, over the boiler, to the stern. The first part is a broad balcony, with the officers' rooms on each side, and the captain's and clerks' offices, &c. Then comes "the free and easy," where gentlemen may lounge and smoke. Next is the gentlemen's cabin, very elegantly fitted up; in this the berths are fitted up on either side, or shut off by doors, into private state-rooms. So many as 100 berths are frequently found in this part of the larger boats. After this cabin comes the ladies' cabin, separated from the first by a glass door and blinds; it is fitted up in the same style with the other, and has every accommodation that can be desired. The balcony at the stern is peculiarly the property of the ladies. Above the cabin is the steerage, or place for deck passengers, where they make the best of it. They find their own bedding and food. The sides are open to the weather, though curtains are provided to keep out the rain, and hammocks and unfurnished berths to those who choose to use them. The passengers have a large fire, at which they may do their cooking, and every other requisite; so that people who are accustomed to "rough it," feel quite pleasant and comfortable; they have the range of the upper deck, or roof, where most of them spend the day, from light to darkness, in a voyage, which frequently lasts from twelve to twenty days. It is quite a mistake to suppose that any familiarity takes place between the deck and cabin passengers; the line of demarcation is as strictly observed as upon our own steamers. A deck-passenger in the cabin would be made to pay cabin fare if he went into it for a minute. In the Eastern boats the same rule is not observed, but will, no doubt, soon be established. Indeed, the inconvenience is very trifling. If any annoyance is felt it is generally produced by old country people; the Americans generally try to behave as ladies and gentlemen, no matter what their rank or condition. During my rambles in the United States, I never experienced rudeness or bad breeding from any persons but English, Irish, and Scotch—the first particularly, who always appeared to be out of humour, and who, you would suppose, were prisoners on their parole, from the manner they faulted every thing, and praised up the father-land, when they all wished themselves back again.

To return to our subject. The main-shaft used to be placed very far forward, about the place of the second fifth of the boat's length from her head. But latterly the position of the shaft has gone more aft, so that it is now, in the largest and newest boats, as near the stern as possible. Every move aft was attended with increase of speed, which may be readily explained; the back-water from the paddles filling up in part the vacuum produced in the water by the motion of the boat forward—and, again, the paddle-boards biting into water much stiller at or near the stern than the surface-water or wave which is thrown right and left off the bows, and in which they formerly worked. The difference in this way must be very considerable. The filling up the cavity in the water behind a very long boat, which has parallel sides and a very short run, is a matter, I conceive, of great importance, and must add greatly to her speed. I have often speculated on the advantages which might be expected from paddles so constructed that they would dig the water from a steamer's bow, and at the same time impel her; but taking every thing into account, and looking to nature for a model, I do not think that the advantages would at all balance or come near the disadvantages of such an arrangement. The filling up of the vacuum as detailed, has been found very beneficial.

The large paddle-boards are now divided into two, so that the concussion of the board against the water is also divided into two. The chance of the board breaking is diminished one-half, and the facilities of mending doubled; the practice is, accordingly, found beneficial, though I do not think the plan good in water free from drift, for it breaks the water too much. In theory, a pair of paddles should present a larger transverse section to the water than the boat itself, so that they should not move the water they come in contact with, but that it, by reaction, should move the centre of the paddle-wheels forward in the direction of the ship's course. My meaning will be understood, by supposing the paddles to be formed of spikes, which strike into the bottom of the river, and come out without strain. If we suppose such a contrivance set in motion, the boat will be, as it were, "polled" forward, and no fluid moved but that which the boat itself displaces, a great part of which will fall into the cavity behind, provided the boat is moved at a proper velocity, and is shaped correctly. I think I can foresee a great improvement in inland navigation by the adoption of this principle in a combination of railroads and canals, the body of the load being carried on the canal, and the speed obtained by the bite on the rails. From the data already furnished, one would think that a speed of 50 or 60 miles or more per hour might be obtained for flat boats in this way, which would displace no water or raise no wave before them at this speed, that is to say, if the tables published are correct. There are several considerations that make one suspect that the reason a great wind smooths the sea is because of its great velocity. This also accounts for the rising of cannon-balls from the surface of the water, &c. Experiment will decide the speed at which the boats must be impelled to attain the skimming velocity, when the fluid surface becomes a railroad of perfect surface. We can readily see where the canal should be deepened to allow of the boats to float, at those places they would have to stop at or start from. The quantity of water would be inconsiderable which would be required; and that horrible motion would be avoided, which upsets one after travelling a few miles on those railroads now in use. Perhaps this project will be considered as foolish as the pneumatic or undulating railroad; but who knows, it may have its day, like many other movements, in the march of mind? I hope none of your readers will be so foolish as to take a patent out for this plan; if they do, and it succeeds, they will surely make me some compensation for its discovery, and give me and mine the use of it, when we pass that way.

I must return again from my digression. I believe I started from the paddle-boards, which are secured to wooden bars, inserted into iron mortices, in a kind of star-shaped head, or chuck, which is fixed on the shaft at each side of the paddle. By this plan the arms are easily repaired or replaced, without deranging the general "rig" of the paddle. On these arms the paddle-boards are firmly secured, at proper distances from the centre, according to the load of the vessel. The main-shafts are attached to the fly-wheel, which pulls one by a short crank and pushes the other in the common way. The fly-wheel is absolutely necessary, one cylinder alone being always used in all the boats, which have been approved of, with the exception of one, which I may hereafter mention. It is of use in pumping, and doing work when the paddles are not in gear. The fly-wheel stands exactly over the kelson, and is secured by a frame extending the whole length of the vessel, which is connected with the kelson. This frame may be called the backbone of the vessel; it is this that distributes the moving-power to all the parts, and communicates all the impediments or re-actions through the pitman, which connects the fly-wheel crank to the engine itself. The cylinder is placed horizontally, no matter how large it is; and, for the purposes of "land and water" navigation, this is decidedly the best position that can be found for it. The push is in the direction of the ship's motion, and the consequence is, that the shafts last much longer, from not being exposed to those sudden jars, which cause so unpleasant a feeling or pulsation in all craft impelled by perpendicular pistons. The annals of railroads furnish evidence already of the vast superiority of the horizontal over the vertical cylinders. The piston-head is furnished with a cross-bar, the ends of which are provided with a pair of skeins, which firmly grip a bar of plate of iron, firmly secured on each side of the frame. This plate is kept extremely well oiled, so as to avoid friction, for it supports the whole weight of the piston-head, and half that of the pitman at all times, and occasionally a large proportion of the weight of the piston itself, and a proportion of the weight of the other half of the pitman. It is necessarily very strong, and longer than the stroke of the engine. It is a very primitive and simple apparatus, but wonderfully cheap and effective. They are adopting it in preference to the beautiful parallel motion in the steamers on railroads.

The cylinders to the engines are of all diameters, from a few inches to 40; they are from 40 inches to 90 inches in length; and as no two steamers use steam of the same elasticity, it is next to impossible to state the moving-power of any of them, though it is certainly very great in some. I have often wished and intended to make a log, and test by actual experiment the speed of these vessels, but, unfortunately, neglected it. The estimated distance between different places on the river is quite uncertain, and may vary very much according to the quantity of water. But *guessing*, as every body will who has been in America for a long time, I would say that the Whale, a tow-boat, employed from the Gulf to New Orleans, is the quickest steamer I have seen in Europe or America, and I think I have seen four-fifths of all the steamers in the world. I have not seen the Lexington, a new vessel plying from New York to New Providence, or the steam-raft; but I have seen nearly all the English, Scotch, and Irish boats, and travelled in many of them, yet I do not think any of them could keep up with the Whale, which is a perfect model for sailing, and has a most powerful engine on board.

Cotton packing has been substituted for hemp with success; but a material is *still wanting as a substitute* for both. I *never heard of metallic* stuffings being used, nor of the lower side of the cylinder wearing so as to be unfit for use. The cylinders are planed out, and not turned, when they are large; small ones are turned, but this is a matter of little moment. The valves are of the puppet form, and each is independent of the others. The simple leverage acts by means of four eccentrics, coming from the main-shaft, or one or two, as the case may be, so that the valves are opened and shut at the proper moment, to take advantage of the spring of the steam, or "cut-off" principle.

The engines are very simple, and finished with taste, little brass or ornament being allowed. From the cross-bar to the piston-head there is a pitman, which works a bell-crank, which works the two pumps, the force or hot, and the cold water. The escape steam passes into and through a vessel called the "heater," from which the supply of water to the force pump is derived, and into which the cold water pump discharges itself. Though the steam-pipe is very large, the noise is very great when it escapes into the atmosphere; it resembles the snorting of a whale at a distance; one can tell at a distance, when the steamer is out of sight, whether she is going up or down stream, by the difference in the sound of the escape steam. If we compare the sound to a cough of some enormous animal, you will easily understand the difference; the coughs produced in going down being full and easy, while those which occur coming up are short and hard. Indeed, our own breathing illustrates the difference when we are moving on a flat surface and going up hill. The different steamers are known by their different coughs, which are heard frequently at great distances at night when the air is still. The difference of sound depends not only on the elasticity of the steam, but also on the rise, form, and material of the eduction-pipe, which is different in all. In some it is made of wood, in others of copper or iron. The mouth differs very much; so also does the shape of the heater or vessel into which the steam rushes from the cylinder, and in which the first sound is made.

The cold water pump is generally made of copper. The hot or force pump, composed of metal, is carefully bored, and fitted with a hollow plunger or piston, which fits it without any stuffing-box. The pitman, which works this, extends to the bottom or head of this hollow cylinder, where it is secured with a pin. By this means the perpendicularity of the plunger is very slightly, if at all, affected by the motion of the bell-crank, and pitman which drives it. These pumps last very well, and are very easily repaired.

The boilers, or generators of the heat, come next to be described. They are composed of wrought-iron plates, generally three-eighths of an inch thick, which are rivetted together by the best American iron bolts, which are worked red-hot, which not only diminishes the labour in making the rivet, but prevents the chance of a flaw or strain in the rivet itself, and actually, by its shrinking in cooling, closes the joint more effectually than could be done in any other way. The joints are afterwards finished and caulked with soft iron, and made perfectly tight. The holes in the plates are often drilled out, or punched by an apparatus, which removes the piece without injuring the texture of the surrounding iron. The ends of the boilers are sometimes made of the same kind of plates, and in the sides, but one of them is generally made of cast metal. In this head an *oval* opening is left for a man-hole, large enough to permit a man to go into the boiler to clean it. The sides of this man-hole are sloped inwards, and as the cover sides slope outwards, a steam-joint is made, which becomes tighter with every increase of pressure from within. It is customary to put some stuffing covered with white lead between the surfaces, to make the joint good. The cover being oval, it can be put in or taken out of the boiler by turning it half round, and then laying it flat. If it were round, it could not be withdrawn. The cover is provided with a female-screw on its outside, into which a male-screw is fixed when it is put in its place. The latter carries a cross-bar of iron, each end of which butts against the steam-boiler, so that when the cover is put on, by inserting this screw into its place, and turning it until the strain is sufficiently great to bring the head into its place, and make the white paint flow, we have the joint complete. Thus one screw is quite sufficient to fix the man-hole. I have been rather particular in describing this part of the apparatus, for I much *approve of it. I do not* recollect having seen it in Europe. Under the man-hole, and below the intended water-level of the boiler, is placed a round opening, intended for the flue, which passes through the boiler. Its rise depends on the diameter of the boiler. The flue is made of the same or thicker iron than the boiler; sufficient space is left between the bottoms of the flue and boiler, that the dirt can be easily removed. The boilers are all made perfectly round. Their length varies from 18 to 25 feet, or perhaps more; diameters from 30 to 48 inches, or less. I am not quite certain of the exact dimensions, for I have no measurements by me, though I am quite familiar with the apparent sizes of the different boilers of the different boats.

The boilers are now generally made of American iron, which resembles the very best Swedish. Its superiority over the English may arise from the excellence of the iron ore, which is the same with the Swedish—from the use of wood in its reduction generally, or of coal, which is nearly free from sulphur. Indeed, the natural advantages of the neighbourhood of the Ohio River, and its tributaries, for the iron trade are so great, and so vastly superior to any possessed by any coal or iron district in England, Wales, Scotland, Sweden, or Russia, &c., that it must rise before *all* of them in importance, if peace continues; indeed, it is impossible to convey an idea of its superiorities. The Americans themselves are not aware of the immense advantages they possess over all the world in this respect. The time, however, is not far distant when the simple citizens of this district will compete with our own mighty iron Lords of England, Scotland, and Wales. Indeed, the number of Europeans employed in the works of Pittsburgh, Brownville, &c., show that the mother country had better take care what she is about in vexing her sons now labouring for bread in the English collieries and iron-works; for they can *all* get employment and better wages in America, at this moment, than they can get at home, and be sure of better and civiler treatment from their employers. I have spent many a pleasant hour working with and looking on at English, Scotch, Irish, and Welchmen, in the foundries and rolling-mills, &c., and never knew one to complain of want of work, or harsh treatment. The heat in summer, and the profuseness of food and general cheapness of drink and fruit, were the only things they had to find fault with. I mention these facts with hopes that they may prove a check to some masters, whose insolence and tyranny is a disgrace to this country.

But once more to our subject. The boilers are all ranged on one foundation-plate, so that the water in all is at the same level. It is supplied to each from a common main which extends from the force-pump. It opens into each. The steam is taken off at the middle of each boiler at top, where it enters a common main which passes to the cylinder. The safety-valve is placed on this at the place of the articulation. The steam is of uniform density in all the boilers, and the water of the same level in each. Such is the nature of this arrangement, that care must be taken to keep the vessel on an even keel, otherwise the boiler on one side might have too much water in it, and that on the other too little. Indeed, all parties are so well aware of this, that on the slightest " list" or leaning of the boat being perceived, the cry is raised of " right the boat," when the evil is corrected. Though we can easily conceive the nature of accidents which would follow if caution were not observed on this head, yet I do not recollect any accident having occurred from it. From this circumstance we must infer that circular boilers, connected together as described, would not answer for the navigation of the high seas, where a steamer carrying sail, with the wind on the beam, will have more or less list. Each boiler should be independent of the others, or the whole of the boilers and furnaces slung on pivots, so that the rolling of the vessel would not cause a difference of level of the water in the different boilers. The other motions of the ship would have rather a beneficial effect, by stirring up the water, provided the centre of the boilers was in the pitching centre (meta, I believe) of the vessel. The boilers, if very long, might be provided with screens, which would prevent the water running from one end to the other, and preserve nearly an uniform level of water under all circumstances.

I take the liberty of rambling out of my record, because I am fond of variety, *and wish to make innovations*, changes, and improvements, if possible, in every thing. My motto is, " Try all things, and hold fast *only* unto those that are good ;" and also, that every thing is bad which can be bettered in mechanics.

The largest boats have as many as twelve or thirteen boilers, the smallest three or four ; and, considering that blazing wood, ash, hickory, maple, and beech, are used, the combustion or heat is very intense. The furnaces are built of iron, cased with brick, which extends a short distance up the sides of the fire-bed. The furnace-doors open one pair, under each boiler, and a shallow ash-pit extends from one side to the other of the furnace. The flame is contracted by a back to the furnace, which lifts it up close to the boiler bottoms, and thence to their ends, round which it passes, then enters the different flues, through which it passes into heads made of sheet-iron, which are moveable, and open into the chimneys. These heads are very convenient, for they are easily removed, when the flue can be cleaned out, being perfectly straight, by a long ramrod or brush. There is no smoke, except when the fires are lit, unless the fire-place is too full of wood—or some coal is burned, which is seldom done. The furnaces are intended for the combustion of wood of the kinds mentioned only. On the Delaware, North River, &c., pine is burned, but the boilers and fire-places are quite different. Indeed, the modes of steam-navigation on the Eastern and Western rivers, and Northern lakes, are quite different. There is a gentleman in Paris who was much employed by the engine-makers in Pittsburgh, Cincinnati, and elsewhere, in making drawings of engines for boats, sugar-houses, &c., who could supply the minutiæ for engines on the high-pressure principle, if any speculators or our Government wish to construct boats for the African or Asiatic rivers on the Western American principle. He is an artist of first-rate eminence in his line, and gave the most perfect satisfaction to all the engine-makers of the Western country during his residence amongst them. His diffidence is so great, that I fear I should offend him if I were to mention his name publicly ; but if any person wishes for it, I would willingly communicate it to the Editor.

I have now got through a rapid outline

of the peculiarity of the river steam-boat. If I have omitted any details which are interesting, I trust some of your friends will take the trouble of requiring explanation on the subjects omitted. Details of cost of engine, boat, cabin, &c., I cannot furnish from want of specific accounts; but these could be of little use, for the prices not only vary in the same place at different times, but differ constantly between different places. Neither can I tell the wages of officers and men, prices of wood, rates of freight, all of these changing and differing at different places and in different seasons, &c.

Should you think these remarks worthy of a place, I may in another paper furnish you with some hints on the navigation of the Atlantic by means of steam-power, a subject which, I think, has not been considered in its proper bearings. I have some hopes of being able to give an opinion on it, having been made well acquainted with its navigation during more than one voyage, and having studied and examined carefully the advantages and disadvantages of all kinds of steam-craft, and steam-boilers, and engines, both fixed and moveable.

This subject will involve us in the consideration of the shape or build, rig, and general fitting-up of the vessel or packet, so that it will sail well and pleasantly; that it will expose the least surface to the resistance of water at all times, and least resistance to the wind when adverse, and most when the wind is favourable; the greatest levity and strength, consistent with safety which will depend on the nature of the materials used in the construction; the lightest and *most* heating fuel, and best construction of boiler. Indeed, I think I can make out a good case, or, I should say, a better than has yet been made out, which may be improved upon; but this is what I want to be done.

Until my next, which will require a few drawings, I must bid you, Mr. Editor, farewell, thanking you particularly for the pleasure and information I have received from the perusal of your last two or three volumes, which only came to my hands within the last few weeks.

Truly yours,
E. Talebois.

Liverpool, Sept. 21, 1835.

EFFECTUAL CURE FOR SMOKY CHIMNEYS.

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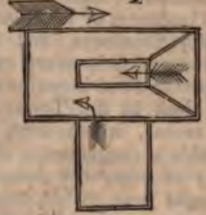

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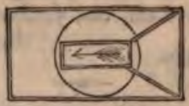

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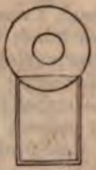

Sir,—As the season of smoky chimneys is arrived, I send you for insertion a sketch and description of a very effective cowl that has, in every case hitherto tried, proved a complete remedy for that worst (but one) of all domestic nuisances.

Fig. 1 represents a section of the improved cowl, which is constructed as the common cowls are, so far as regards the general principle of the revolving of the lateral on the vertical parts of it; but instead of the end opposed to windward being, as is usual, closed, a funnel-shaped apparatus is introduced, terminating in a pipe of about three inches diameter, which is carried just over the opening of the vertical chimney-pot. The effect of this is, that the lateral pipe of the cowl being by the operation of the wind on the vane always turned endwise in the direction of whatever current of wind may happen to be strongest at the time, a draught is created by the wind rushing through the funnel-end of the cowl-top, and the smoke is thereby, with considerable velocity, carried completely out of the cowl. The stronger the current the more effectual the apparatus.

This method of cure has been tried in several instances of heretofore incurable smoky chimneys, and has been entirely successful in every case. It is the production of an ingenious friend of mine, a clerk in the Tower, where a suite of rooms, which were formerly untenantable in consequence of the impossibility of using the fire-place, has been brought into useful employment, simply by the erection of one of those cowls on each of the flues.

I am, Sir, yours, &c.
L. MUNDY.

Oct. 22, 1835.

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COOKING BY GAS—REPLY OF MR. BEALE TO MR. BARLOW.

Sir,—Although I was perfectly satisfied in my own mind, that the charges in my last letter against the infringers of Hicks's gas-cooking patent were unanswerable, nevertheless, some of your readers might suspect from what was announced in your Magazine, No. 635, that Mr. J. Barlow was going to refute them. On the contrary, I find he has done no such thing.

My "grave charges made on weak grounds" bring to light, that part of Mr. Barlow's gas-cooking apparatus cost 3*l.* in the City-road, though he had stated on September 5th, that Mr. Sharp of Northampton supplied him with it for 5*l.* I leave it to the public to judge how these two opposite statements are to be reconciled. That endeavours have been made to "spread abroad a notion that cooking by gas is not the subject of a patent," is not denied. The very language made use of implies the existence of what the interloping parties would fain conceal. Mr. Barlow's apparatus is called "Sharp's *Improved.*" Now what is it he has "improved" upon? On Mr. Hicks's invention, of course—if improved it be, which I deny—though of this the original invention, not one syllable was said. In short, not one satisfactorily proved negative is given to any of my assertions—not even to cooking by gas, with an envelope, being Hicks's patent; for I would give Mr. *Sharpe to* understand, that I call a *conical hood* an *envelope;* although Mr. T. G. Barlow asserts, that it is an arrogant assumption, I do attack the use of gas for cooking under any sort of envelope, hood, or cover as an infringement of the patent.

Although Mr. J. Barlow may not term himself an inventor, yet Mr. T. G. Barlow seems to claim the having given to the Americans a "rough idea" of roasting meat under a metallic cone. Pray, why did Mr. Barlow endeavour to seek out Mr. Hicks when in America; or how could he know that Mr. Hicks was in America at all, and that he was the patentee of this invention, if he had not pretty well investigated the matter before he left this country? He could not have come to all this knowledge without knowing the principle, the application, and the form of Mr. Hicks's patent apparatus. I wish he would say what points those are in which Mr. King ought to be set right, because, as I before stated, any one may see that the extract from the *New York American,* and Mr. Loudon's description in No. 495, are nearly synonymous. All that Mr. T. G. Barlow has stated, tends to verify what I said before on this head. The only excuse he offers is, that he made use of a metallic cone as "the cheapest and least troublesome"!! He says, also, there can be no great crime in not naming Mr. Hicks as the inventor and patentee, "for the defects of Hicks's apparatus must be apparent to all who have witnessed its operation," &c. But why not tell us what these defects are? And why did he make use of such a defective apparatus in America? Oh, because it was the "cheapest and least troublesome"!! Yes, truly, and he might have added, the one also in which the fuel is most economically applied.

At the commencement of Mr. T. G. Barlow's letter, Mr. J. Barlow is styled "a humble individual," who, "without the remotest prospect of personal gain, desires to increase the public convenience;" and at the latter part of the same letter we are told, that he is ready to go to law. He must be very philanthropic if he would go to law for the public convenience merely.

Again, it is stated, "Mr. J. Barlow's object was not to recommend either this or the other machine." But how does this agree with his letter, which appeared in your Magazine on the 5th of September?

"The whole matter," says Mr. T. G. Barlow, "resolves itself into a dispute between the inventors of two rival apparatus." Not so; but into a dispute, of which this is the sum and substance—whether a person who only claims to have *improved* on the invention of another, is to be considered as himself the original inventor?

Mr. Ricketts and Mr. Sharp are, according to Mr. Barlow, "the only persons who have really constructed an effective and economical apparatus." But as regards Mr. Ricketts, he has owned, and I can prove it, that he *borrowed* his from Hicks's.

It is to be remembered, that Mr. Hicks's is an original invention; and admitting, for the sake of argument, that either Mr. Sharp or Mr. Ricketts have improved it, they cannot legally make use of it without the consent of the proprietors of the patent. Could Messrs. Boulton and Watts have been robbed of their patent by any one that had constructed an engine with a square vessel instead of a cylinder; a square piston-rod or square air-pump? Certainly not. Neither can any one justly deprive Mr. Hicks or his assigns of his invention, because the envelope they make use of is square or otherwise. I feel no hesitation in saying, that they would find some difficulty in proving themselves legal pirates, *sharp* as they might be.

Does Mr. Barlow think that the patentee was such an arrant fool as not to have claimed a cylindrical, or cubical, or any other shaped hood (or envelope, whichever Mr. B. may please to call it), if such was legally necessary? I beg leave to inform Mr. Barlow, that Mr. Hicks tried experiments on all those different forms, and on different kinds of burners also, and concluded, that the form shown in his specification was efficient, which is all that the law requires, viz. for one efficient method to be shown; otherwise his specification would have reached from here to Northampton, and it might have been necessary to state in it, that a calf's-head or other viands might be cooked within a hat or a bushel, *&c. &c.*

But it is useless to swell out these pages with a matter which I can very plainly see will have to be decided elsewhere. I feel obliged to you, Mr. Editor, for the space you have hitherto allowed me.

Many of my charges appear to have fitted Mr. Barlow, as he seems to have taken them upon himself, and may be, it is quite as well for him to answer them as any one else.

> "When caps amongst a crowd are thrown,
> Those whom they fit may put them on."

I still persist in all I have asserted, and therefore "leave it to your readers to decide against whom the charge of 'unjust and unmanly' conduct may most truly be brought."

Yours respectfully,
J. T. Beale.

11, Church-lane, Whitechapel,
Nov. 3, 1835.

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PRINCIPLES OF RAILWAY LOCOMOTION.

Sir,—Nothing gives me more pleasure than to acknowledge an error, and to rectify it as soon as it is pointed out. Now, although Mr. Anti-Carper does not positively assert that there is an error in my last theorem for ascertaining the velocity on inclined planes, yet he calls upon me to give a demonstration of its accuracy. In proceeding to comply with his request, I discovered that I had made a slip. I asserted that if V is the velocity in miles with which a body is projected down an inclined plane, whose length is S, and perpendicular descent h, the last acquired velocity in miles will be $V + \sqrt{2gh}\cdot\frac{15}{22}$. This, upon examination, I find should be, $\sqrt{V^2+2gh)}\cdot\frac{15}{22}$. And here I must inform Mr. Anti-Carper that he (unwittingly, no doubt) has made his friend Mr. Herapath's formula for finding the velocities on descending planes more glaringly absurd than I at first imagined it to be. Call you this "backing your friend," Mr. Anti-Carper?

The demonstration of the theorem $\sqrt{V^2+2gh}\cdot\frac{15}{22}$ is very simple.

Let V be the velocity with which a body is projected down the plane, v the last-acquired velocity, S the length of the plane, and i its inclination. Also, let S′ be the space a body must move over (on a like inclined plane), commencing from a state of rest, so as to acquire the velocity V. Then $S' = \frac{V^2}{2g \sin. i} \therefore S + S' = S + \frac{V^2}{2g \sin. i}$; then v, the last-acquired velocity, will be $v = \sqrt{\left(\frac{V^2}{2g \sin. i} + S\right) \cdot 2g \sin. i} = \sqrt{V^2 + 2gS \sin. i} = \sqrt{V^2 + 2gh}$, or the last-acquired velocity in miles per hour, will be $\sqrt{V^2 + 2gh} \cdot \frac{15}{22}$.

The following is a table calculated for descents on 1, 2, 4, &c. feet per mile from Mr. Herapath's theorem, and from the above theorem; in both cases the starting velocity is 30 miles per hour, and the force of steam applied so as to overcome friction :—

Fall in feet per mile.								
1,	2,	4,	6,	8,	10,	12,	14,	16,
Velocities acquired on descending one mile, deduced from Mr. Herapath's theorem, $\frac{30}{1 - \frac{h}{22}}$.								
$31\frac{1}{7}$,	33,	$35\frac{5}{9}$,	$40\frac{1}{4}$,	$47\frac{1}{7}$,	55,	66,	$88\frac{1}{2}$,	110,
The same, calculated from the theorem, $\sqrt{V^2 + 2gh} \cdot \frac{15}{22}$.								
$30\frac{1}{2}$,	31,	$31\frac{9}{10}$,	$32\frac{4}{5}$,	$33\frac{4}{5}$,	$34\frac{3}{5}$,	$35\frac{1}{2}$,	$36\frac{2}{5}$,	$37\frac{1}{10}$.

I intimated at the conclusion of my last article, that I would go on to make some remarks regarding the accuracy of Mr. H.'s formula for ascending planes; but in consequence of some explanations which he kindly addresses to me, given in No. 12 of his series on railway transit, I find it will be necessary for me first to make a few observations on what he has there stated, and this will no doubt force me to go a little more into the subject than I originally intended to do.

Yours, &c.
IVER M'IVER.

SLATE PLATFORMS FOR RAILWAYS—FURTHER OBSERVATIONS. BY JOSEPH JOPLING, ESQ., ARCHITECT.

Sir,—Considering slate platforms for railways will answer, it will be a subject for experiment to determine the requisite thickness. They should be "stronger than strong enough;" but not unnecessarily so. Two-inch slate has been found sufficiently strong for pavement over which heavy weights have to pass at the London Docks; therefore it is probable that three-inch slate slabs would be sufficient to sustain the loads, and to hold firmly the fastenings for rails. But it would be necessary to make experiments, to ascertain whether the weight of such slabs would be sufficiently great to keep them steady; *the rails being fixed to the platform itself as* proposed, would, however, tend greatly to increase the stability of both. Besides, if the slate slabs are laid in concrete, they may be fixed thereto by means of screws in rough slate blocks embedded in the concrete. In this way, slabs, comparatively light, may be made as steady as heavier ones, depending entirely on their own weight, and the adherence of the concrete. I have stated, that a slate platform something less than five inches thick, would be as heavy as the blocks used near Chalk Farm; but if a less thickness would suffice, the advantage would be the greater.

I have proposed introducing into the platform brass or copper nuts, but perhaps the slate may be tapped to answer that purpose; and it is thought that the thread of the nut or bolt of slate will be found as strong, if not stronger, than the hardest oak. It would require some consideration, and, perhaps, a little experience, to determine the best form of thread, and the best means of drilling and tapping. A reward should be offered for the best plans for these purposes.

I think it possible some improvement may be made in the form of the rail, but it is not necessary to allude to this at present, as, by any form of parallel rail, the requisite thickness and the utility of a slate platform may be determined.

I have made particular inquiries (and, from my own knowledge, I can depend on the information I have received), respecting the durability of Kirkby slate, which I consider particularly applicable for railway platforms.

Gate Posts made of this slate, which have been in the ground from time immemorial, have been examined, and do not appear to be at all decayed; but the part out of the ground is rather harder than that below the surface.

Old Flags, such as you call paving, and also the foundations of old walls, have been examined, and are just in the same state as the gate posts.

Stones (Kirkby slate material) *laying across streams*, have been remembered in the same situation for the last fifty years, and appear no worse, except a little loss of colour; and slates which the salt or sea water has frequently covered for the last forty years, do not appear at all changed except in colour.

This slate material, where, for roofing, it meets the Welsh in the market, obtains a higher price on account of its strength and durability.

In laying the slate platform, and in fixing the rails, the methods proposed are such as will permit them to be taken up and relaid with the greatest facility, and without waste of material. In the event of embankments settling, or the foundations in any place giving way, it will instantly be seen by the slabs being thrown out of their true positions; and by the facility with which the several parts may be taken up and refixed, any repairs may easily and readily be made. But it appears to *me, that* a *railroad roofed with slate slabs, united by strong* iron nails, would protect the foundation from the weather, and render any changes of much less likely occurrence.

It is only by experiment, the actual cost and value of slate platform railways can be ascertained. It may, however, be stated, that where they are adopted, the rails would be more likely to be kept perfectly parallel, and the bed of concrete would not be required to be so thick as the ballasting of the road at Chalk Farm; consequently, in some places a foot or 18 inches would be saved in the excavation. A much less strength of rail would be sufficient; chairs, spikes, keys, oak plugs, and stone blocks, as at present adopted on the Birmingham line, would not be necessary. The cost of all these would be nearly, if not quite, equal to the concrete slate platform and new rail. But the steadiness of a railway thus constructed, would, I should think, be found in the end to be the cheapest, if even the first cost be more, as it would greatly reduce the wear and tear at present experienced, and which is attributed to the vibration of the rails.

I am, Sir,
Your obedient servant,
JOSEPH JOPLING.

31, Somerset-street, Portman-square.

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POISONING BY ARSENIC.

Sir,—There has no poison been employed for the purpose of destroying human life, to an equal extent, or with deadlier certainty, than arsenic. Vegetable poisons discover themselves generally both by colour and taste; laudanum imparting a dusky brown hue to coloured wines, and a dirty greenish hue to liquids generally; and opium, by a disagreeable odour and nauseous taste, is easily distinguished in very small quantities in articles of food. Oxalic acid held in solution is known by its bitter taste, and the mineral salts in the same manner are known by their acidity; but arsenic being tasteless, without any smell, and colourless, is therefore more difficult to detect by the immediate senses, and hence affords the greater facilities for perpetrating the most diabolical crimes through its agency.

Chemists and medical men in England, but more especially in France, have given their attention to devise some method to detect this poison by the aid of the senses of sight and smelling, and without subjecting the suspected preparation to chemical tests; but hitherto no very satisfactory results have been obtained. "From 1824 to 1832, the number of individuals accused of poisoning with different articles, in France, was 273, and it appeared in many instances that the intended victims had been saved by the bad taste communicated to the food by the poisonous substance." It is obvious then, that, if some one colour were given to arsenic, and universally adopted, and also some particular perfume or odour, the poisoned matter would be subjected to two examinations previous to being used as food. It becomes, therefore, important to discover some colouring matter which, without destroying the medicinal properties of arsenic, will adhere to its particles, and communicate a decided colour to such liquids as milk or wine; and where the quantity of arsenic is so small, that even when coloured it would communicate little or no colour to flour, or preparations of flour, that its presence might be detected by some strong perfume or odour unusual to cooked viands.

Dr. Ferguson, an ingenious chemist in Aberdeen, lately communicated to the police board in that city a method of detecting arsenic as poison, by mixing with it charcoal or lamp-black, and adding a few drops of oil of origanum or thyme, which gives a strong taste and smell easily detected. The French chemists have recommended poisonous substances to be flavoured with musk and made bitter with aloes. Either method, I conceive, would answer the end intended; and the subject deserves the attention of every police and medical board, on the principles of benevolence and public security.

It should be recommended to apothecaries in every town and village in the kingdom by the police and magistracy, to use the precaution of colouring and perfuming arsenic. Let them be unanimous in adopting one colour and flavour, and let means be taken to make the public aware what they are, and how to be known, and, I am persuaded, that fewer instances will occur of persons *being* poisoned, or of attempts being *made to poison, by* arsenic than at present, where the properties of the metal afford such facilities for using it to destroy human life.

J. K—N.

Chiswell-street, Nov. 9, 1835.

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SELECT COMMITTEE OF THE HOUSE OF COMMONS ON ARTS AND MANUFACTURES.

MINUTES OF EVIDENCE.

(Continued from last Number.)

James Morrison, Esq., M. P., examined:

You are at the head of a large commercial house in the city, are you not?—I am.

Of the well-known firm of Morrison and Company?—James Morrison and Company is the name of the firm.

You are large purchasers of manufactured goods in this country, as well as on the continent, are you not?—We are large purchasers of manufactured goods in this country, and also purchasers to a considerable extent of goods on the continent for home trade, as well as for export trade.

You of course have been well acquainted for many years with the relative state of the manufactures of this country and other countries?—I have been well acquainted with the state of the manufactures of this country for more than twenty years.

Has your acquaintance with this subject induced you to make any observations on the inferiority or the superiority between British and foreign manufactures, as far as the arts of design are concerned?—As a matter of business, I have been long acquainted with the general state of manufactures, and as a matter of curiosity I have paid attention to the arts of design as applied to manufactures in foreign countries.

Do you consider the English manufactures superior as far as regards the manufacture of the goods, but inferior in that portion of them which is connected with the arts?—I have found generally that we have been very much superior to foreign countries in respect of the general manufacture, but greatly inferior in the art of design.

What are the principal articles in which you consider our inferiority in art is perceptible?—It is very strikingly the case in all the arts of design connected with the silk manufacture, which is essentially a fancy trade.

To what circumstances do you attribute the superiority of foreign manufactures in art over our own?—To the fact that on the continent they have public schools for teaching the art of design; that it has been part of their system to educate men as professors of the art of design as applied to the manufactures, and also as teachers; whereas in this country we have neither the one nor the other.

Have you not had an opportunity of visiting establishments abroad for connecting design with manufactures?—Having travelled on the continent on different occasions, I have always visited the manufacturing establishments with a view to judge of their state as compared with that of England.

What institutions have we at home corresponding with those abroad, which you think will in any degree enable the manufacturing population to acquire a knowledge of art?—For the improvement of the arts in connexion with manufactures we have no establishment whatever. At the Royal Academy the attention of the students is directed chiefly to the human figure. We have, I believe, private teachers in London, but I hear that they also apply themselves more particularly to the human figure, and in fact they educate people for painters and sculptors, rather than as artists for manufactures.

There does not exist in this country that cheap mode of acquiring a knowledge of art, which abroad is demanded by the manufactures?—We have no kind of public school of art as applied to those objects. I believe I can state that with regard to several of our large towns, though there are persons that are called designers, yet they have not been educated as such, and, in point of fact, they know little of the principles of art.

Do you think it would be of great importance to our manufactures to encourage a familiarity with design among the manufacturing population?—There is no doubt that it would be desirable that it should be encouraged, and I should say in this country more especially it seems an absolute necessity, because some branches of our manufacture really languish from the want of encouragement in the art of design. I should further say, that with respect to the art of design, there is no want of encouragement on the part of the public, and that we are now, and have been for a long time, obliged to resort to the continent for the purpose of purchasing their new designs, and in fact our manufacturers have been greatly benefited by the opportunity of purchasing foreign art in that shape.

You mean to say that even the competition, with the opportunity of seeing their patterns, have been a benefit to our own manufactures?—The truth is, we have generally copied the French patterns, and if we have attempted to alter, we have only injured them, so that, in point of fact, they are all French; I am now speaking more especially of the silk trade.

Have you ever been struck with the great attention and activity the *subject of patterns* excites in France, and that it increases the value of the article?—I consider it is a matter on which the manufacturer there chiefly relies, and if he is fortunate in his patterns he makes a successful year; if otherwise, his profits are materially less.

Is it not generally the opinion of the French, that the man who is lucky in a pattern, is the fortunate manufacturer of the year?—Certainly. I have understood in certain houses that the manufacturers were doing well, because they had been fortunate in their patterns; their success for the season resulting from their superiority in that respect.

That shows the importance they attach to it, does it not?—Yes.

Is it perceptible in such articles as silks, ribands, shawls, gloves, and also fancy goods of every description, that they have this superiority?—It applies more particularly to the silk trade, but it applies also to woollens, and generally to all articles in which there is a figure.

Does it not also apply to metals?—The art of design more particularly applies to the metals, in which I think we are greatly deficient.

Does it not apply also to the arts as applied to architectural decorations, and the designs with respect to houses?—Particularly so; I understand from architects that there is a great want of that kind of talent in connexion with architecture; so that however good a design may be, the parties executing it not having been taught the principles of art, are not able to execute fine designs as they should be.

In the architectural changes that have been going on, have you been struck with the want of that superior taste which you think we ought to have?—Yes, the deficiency is certainly evident.

In fact, there is a connexion of course between the arts; the higher branches of the arts, and mere household furniture?—Architects have, I believe, attended to that subject of late years more than they formerly did, from the labours of Mr. Bullock some years ago, and I would add especially the publication of Mr. Hope's book. Much improvement has taken place; but no doubt great advantage would further arise from the establishment of a school of art, embracing form, proportion, and ornament, and this advantage would not be confined to the manufacturer of furniture, but it would be extended to the country at large, because it would give employment to many, as well as be an improvement to the public taste.

Is not that perceptible, the connexion between the classical, the antique and the common purposes of decorating the interior of houses in many instances in which the patterns from Pompeii have been adopted with great success in public as well as private mansions?—Without entering on questions connected with the higher orders of art, I should say all those matters influence our taste, but I have some doubt whether they would be suitable to our habits.

Have you observed in Paris, that much of the designs of Pompeii have found their way into the shops and private houses?—I cannot say that I particularly observed them there.

But in those buildings lately in London, do not you trace in the alterations of the Pantheon and in the decorations of the Lyceum Theatre, the very same designs that you trace in Pompeii?—No doubt of it.

Does not the Arabesque style, which was a style peculiar to Pompeii, prevail very much at Paris?—I have observed it in France, and also in Italy, and I am told that the Arabesque, about thirty-five years ago, prevailed in this country.

Are you aware that in Italy the class of decorators form a very numerous class indeed, particularly in Southern Italy?—I should suppose from their works it must be so.

And are you aware that there are scarcely any houses, except the very lowest houses, of the inhabitants which are not in some way or other decorated by one or other of these decorators?—One sees the evidence of a feeling in favour of art every where in Italy, and one rarely observes it here.

Did you, upon the whole, observe, during your excursion on the continent, where there was existing a great mass of population, and where there were fine specimens of the arts, either in architecture or sculpture or painting, that a taste in favour of the arts appeared to be general and diffused, and to be operating upon the mass of the population?—There is no doubt that, admitting the public at large, especially the working classes, to see fine collections of works of art, has been eminently useful, and that it gives them a taste for the high character of art.

You think it very desirable to encourage the arts as connected with the architectural decorations of the interior and the exterior of our houses?—I alluded to that in connexion with the manufacturing arts; and I think it is very important that they should be encouraged.

Do you think that the French are more skilful than we are in the combination of colours and in chemistry as connected with manufactures?—I think they are. We have to lament that we have not a better educated class in chemistry as well as in the art of design. I believe the French are superior to us in both these.

(To be continued.)

NOTES AND NOTICES.

A New Paper-Hanging, of a splendid description, has just been manufactured by Mr. De la Rue, the embossed-card manufacturer, who has been for many years at a considerable expense in bringing it to perfection. The pattern is embossed; in metals it is remarkably rich, particularly so with a flock ground. I was favoured with a view of a room that has been recently hung with this new paper at the manufactory in Bunhill-fields, and was very much struck with it; the pattern was embossed in gold, with a dark-green flock ground, and the effect produced was magnificent. Another pattern is in imitation of a very richly-embroidered shot-silk. A specimen of this paper has been submitted to his Majesty, who was very much pleased with its splendid appearance. The price varies from 1*s*. 8*d*. to 2*s*. per yard; and in metal, from 2*s*. 6*d*. to 3*s*. 6*d*. per yard, according to the pattern.—*Mr. Laxton; Archit. Mag.*

During the past week, the construction of some additional drains was commenced in the neighbourhood of Finsbury; but the workmen have been brought, for the present, to a stand by the remains of one of the old London walls, which they have encountered at the great depth of from 45 to 50 feet below the surface, running in a direction at right angles to their excavation. The materials of which it is composed form so compact and hard a mass, that it is impenetrable even to cast-steel tools. The parties at present employed would be thankful for any information that might facilitate their labours.—*From a Correspondent.*

The New Paving.—Sir, I doubt whether it is well understood by your readers, that in the new paving, which has been the subject of frequent observation, two distinct plans have been introduced, the "*serrated*" and the "*striated*," and that specimens of each were laid down on Fish-street Hill. As one of them, at least, is now on trial upon a large scale, time will show if the invention, like many others, has been "*overrated*;" and the knowledge that there is more than one plan, may prevent names, which are introduced as having claim to the invention, being "*underrated*."—O.—Nov. 10.

If Mr. Lunt will send us a descriptive explanation of his drawings, we shall put him to no expense for engraving them. We have often stated, that we are always very willing to defray the cost of any engravings which may be necessary for the illustration of communications of public utility and interest.

Mr. Merrick—answered by post.

Communications received from H. P. H.—J. B.—Mr. Smart—Mr. Squire—O.—Mr. Barton—A. Y.—Tyro—Mr. Deakin.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles Esq., C. E., is just published, price 6*d*. Also, the volume complete, in boards, price 9*s*. 6*d*.

☞ Patents taken out with economy and despatch; Specifications prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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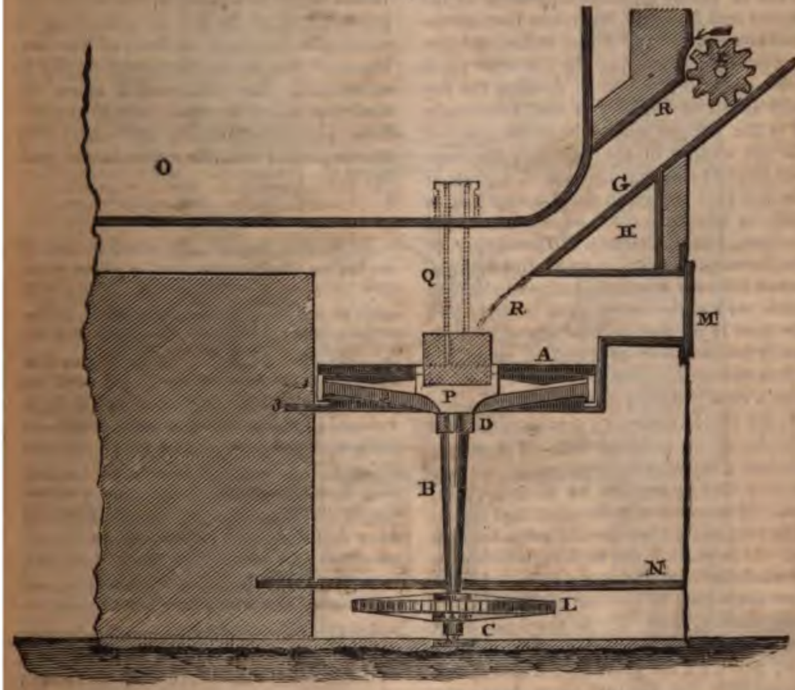
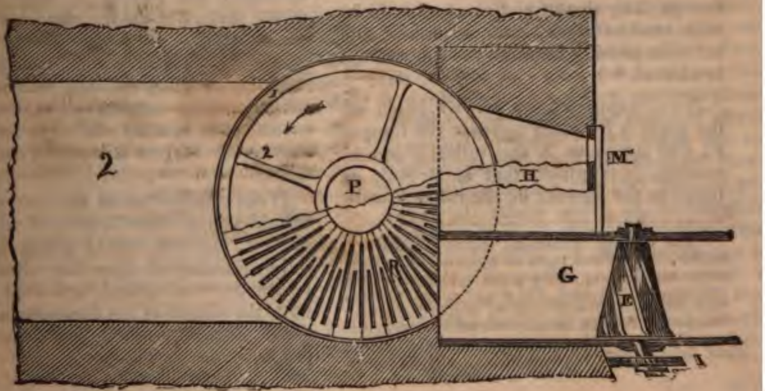
SELF-FEEDING AND SMOKE-BURNING FURNACE.

Fig. 1.





DESCRIPTION OF A SELF-FEEDING AND SMOKE-BURNING FURNACE INVENTED BY MR. JOHN STEEL, ENGINEER.

(Communicated by a Friend of the Inventor.)

A is a circular fire-grate of any suitable dimensions, which is moveable on an upright or inclined axis B, turning on a toe or centre C, and supported at the upper end D by a bar made fast in the brickwork; E is a fluted roller, for the purpose of supplying the fire with coals (this roller or method of feeding the fire will admit of a variety of modifications); F is the hopper where the coals are put for the supply of the furnace; the hopper ought to be furnished with a grate at the top (not shown in the drawing), so as only to admit of coals of a limited size, for the greater accuracy of the supply of the furnace. G G G is an inclined plane, set at such an angle that the smallest of coals will slide down with facility, and the part H of the inclined plane may be made hollow, and kept full of water, by a free communication with the boiler, in which case it forms a part of the boiler. I L are catch, screw, or common toothed wheels, so as to be worked by a catch-motion, a screw, or common wheel-work, or they may be worked by a band, chain, &c. M is a common fire-door and frame. N is a metallic plate for the ashes to drop on. O is part of the boiler, which may be made in any shape or form. Fig. 1 represents part of a boiler of the common construction, and fig. 3 the end of a boiler with tubes; 1 1 1 shows the ring or rim, and 222 the arms of the rim which supporteth the fire or grate bars; the ring or rim is made a little deeper than the arms, and turns round in an iron trough 33; this trough is to be filled with sand or ashes, &c., to prevent the air from passing between the rim and the brickwork.[*]

Now, suppose a fire to be lighted on the grate A A, coals put into the hopper F, and the grate A and roller E put in motion, it is plain, that such coals as lodge in the notches of the roller E will, as the roller turns round, be dropped on the inclined plane, and from thence scattered on a portion of the fire; and as the grate is moving round at the same time, another part of the fire is continually presented to each fresh supply of coals. It will be seen, fig. 2, by the direction of the arrow, as the grate and fire turn round from left to right, the coals that are dropped on the fire are advancing towards the fire-door or front of the fire; hence all the smoke must necessarily be consumed. The letters RR show the direction which the coals take in the sections (see figs. 1 and 3, and where they are deposited on the grate in the plan fig. 2.)

Observations.

In feeding the fire by hand in the old way, it is well known that a great quantity of coals are thrown on at one time, and, at the first instant, the effect is literally a great tendency to extinguish the fire; but as the fire is usually powerful enough to overcome this, the next impulse is the bursting forth of a large volume of dense black smoke, which has little or no heat to impart to the different objects with which it comes in contact; yet, had this smoke gone over a bright fire in small quantities, the whole would have been ignited and become a very essential part of the fuel, instead of passing out of the top of the chimney, and enveloping the whole neighbourhood.

In the new revolving smoke-burner, the fuel being scattered on the fire by a well-regulated motion, in such an infinity of parts that each particle becomes instantaneously ignited, and the smoke or hydrogen gas having to pass over the whole surface of the fire, the whole of the combustible matter must necessarily be consumed. In using this furnace where there is no steam-engine, Mr. Steel employs any other moving mechanical power which the locality of the situation may point out, or it may be turned by hand.

If the mechanism of the smoke-burner should at any time be out of repair, in order to keep the work going on, it is only necessary to stop the wheel-work, let the grate stand still, and feed the fire with the shovel at the fire-door, as in the usual method, till the parts are put in repair.

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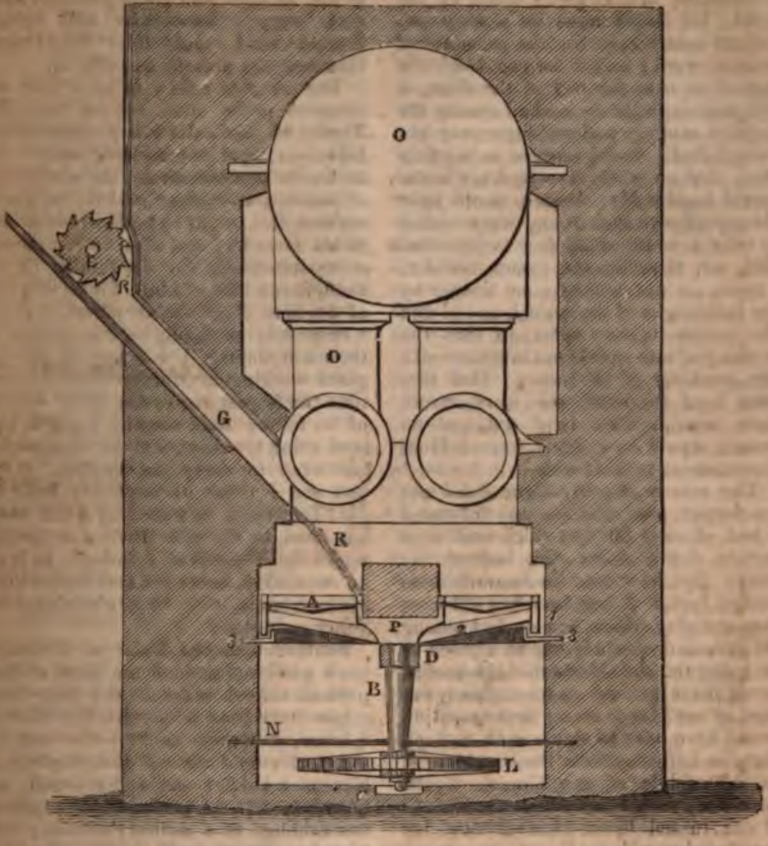
[*] The inventor sometimes makes the fire-bars hollow, and secures them all fast and water-tight to the centre piece of the grate at P; each of the fire-bars, in this case, has a free communication with the centre pieces, and the centre piece with the boiler, through the pipe shown by the dotted lines Q; the outside of this pipe to be made water-tight, in the inside of the boiler, by a stuffing-box.

Fig. 3.



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THE THAMES TUNNEL.

Mr. Editor,—Some person connected with the Thames Tunnel has at length made us acquainted with the new movements of that concern, through your excellent Magazine. He begins his communication to the public (and no doubt but it is a very candid and proper report), by holding up to ridicule some one that has advised their directors and their engineer to hold up the Thames with bars of iron, something like nail rods, 8 feet long, with sheet-iron, quarter of an inch thick, to cover them. He tells us, also, of other plans that have been offered them to the amount of 300—wood, leather, and tarpauline plans——*weights-under, weights-over,* and no-weights-at-all plans)—besides which, there are, it seems, 90 plans not revealed, the authors of which think them too good to give away for nothing. He is very right in holding up such plans generally, to ridicule, for many of them are quite laughable, and some are an insult to common sense. However, there is one plan among the 300 that he has not at all taken notice of, which plan may be seen in the *Mechanics' Magazine,* No. 216, p. 204. I should wish him to examine that plan, for I do think if it were not for one reason, namely, that it did not originate in London, he would adopt it in the next tunnel he makes under the Thames.

Now, Mr. Editor, I do not wish to undervalue Mr. Brunel's merit in the least; his shield must be a most excellent contrivance for the purposes of such a work; and if he can finish the tunnel so near the bed of the river, it will and ought to be ranked among the boldest mining undertakings ever accomplished. I will venture to say further, that no other man perhaps in the world besides Mr. Brunel, would have attempted with such or any other means, to take a width of 38 feet before him. But, sir, *there* lies the grand mistake; I mean, in not having gone deeper by the full height of the tunnel, and placed the arches further apart, so that the working of one should not interfere with the working of the other. Had that plan been followed, the work would have been finished long ago, and no money would have been wanted from Government to do it with.

The reason why Mr. Brunel did not go deeper was, that he was informed a bed of sand 50 feet thick was at a certain depth under the bed of the river. But how does he know that to be the fact? I beg leave to tell him, that the plan which he may find among his 300, and which is above alluded to as being in the *Mechanics' Magazine*, would have proved whether there was sand or not; for the very first operation would have been to sink a shaft so deep that the drift-way from the bottom of it to the middle of the Thames would have been rather more than the height of the tunnel lower than it now is; the tunnel would then have commenced both ways out, with a moderate rise; and although it would have commenced under the middle of the Thames, the height of the tunnel deeper than it now is, it would have been nearer the surface at the two sides of the river than the present tunnel is. The practicability of completing the job would have been thus proved at once, namely, by the shaft in the first place, and then by the drift-way to the middle of the river; and the strata, too, would have been ascertained. By the present mode an immense sum of money has been expended before coming to the most difficult part of the tunnel, on the mere chance of being able to complete it; while nothing, in point of convenience, *has been gained by having the* tunnel so *near the water in* the middle, for by beginning the tunnel under the middle of the Thames, and going gradually out each way, a handsomer and better-formed road would have been made than ever the present one will be.

The reporter refers us to a hole attempted to be made by the late Mr. Trevithick, and calls him a remarkable, ingenious, and enterprising man. So he was in steam-engines; the whole host of locomotive-engine makers, railroad-makers, &c., ought to build a monument to his memory, and also do something more substantial for his family (if he has left any behind him), for he was one of the first, if not the very first, that set a steam-engine agoing on tram-plates in these kingdoms. I saw one of his engines working at Merthyr Tydvil more than thirty years ago; the chief reason of its failure then was the turns in the road being too short, and the tram-plates too weak to carry the engine. Now you see I think uncommonly well of Mr. Trevithick as a steamer; but what has that to do with driving a tunnel under the Thames at London? Is it to be concluded, because a man is clever at his own trade, that he is also clever in yours and mine?

Neither does the Duke of Wellington's good opinion of the plan of the present tunnel make it the best that might have been adopted. The Duke, I know, is a good soldier—the best in the world, no doubt—I always admired him as a soldier and a man—and, no question, but he understands sapping and mining, as a military science; but what has that, also, to do with the best plan of a tunnel under the Thames?

However, neither the late Mr. Trevithick, nor Mr. Brunel, nor the Duke of Wellington, nor Dr. Wollaston, nor Mr. Donkin—not all, nor any of them—would (had they but practice in such things) have driven a drift-way, big or little, so near the water under any tide-river or sea, that the water in that said river by its weight (when the tide comes in) actually and visibly presses the alluvial matter, mud, &c., through every hole, however small; as the reporter says was the case with the drift-way Mr. Trevithick made, until it finally finished it. I will say, that while the weight of the tides presses, and squeezes, and agitates the earth over the tunnel's front, or end of the shield, irruptions may yet be certain.

Had the Thames Tunnel been one height, deeper under the middle of the river, the weight of the water would not have had any effect upon the roof of the tunnel. The neglect of such precaution has been the ruin of all jobs of the kind hitherto attempted in this country. By sinking a shallow shaft on the side of the river barely deep enough to skim the bed of the river in the middle, the work goes on very well at its commencement, and while there is cover over head; but when they get to the middle of the river, where they want protection most, there they have none; whereas had the shafts on the sides been sunk sufficiently deep, and a drift carried to the middle of the river, and the tunnel begun there both ways out, rising gradually out each way, as the form of the bed of the river would allow, the work would have been practicable, and to a certainty, accomplished.

Your obliged,

THOMAS DEAKIN.

Blaenavon, Nov. 7, 1835.

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THE GREENWICH RAILWAY.

Sir,—I owe an apology to yourself and to your readers, for having so long delayed to reply to the letters of Anti-H. and of Mr. Herapath, in answer to my remarks on the Greenwich Railway in the last Number of vol. xxiii. The fact is, that I had very nearly concluded a retort courteous to the former (which accompanies this, and I hope will not be too late for insertion), when an unforeseen event took place, which not only prevented the conclusion of that task, but took away all opportunity of exposing the misrepresentations of Mr. Herapath (under his own hand and seal, in his paper of October 10th), at an earlier period than the present. I now lose not a moment in performing this duty, in the confident expectation, that, altered as Mr. Herapath's position with regard to the *Mechanics' Magazine* may have since become, its pages are still as open as ever to free discussion and plain speaking "On Railways," as on every other mechanical subject.

I could not help being a little amused at Mr. Herapath's ingenuity in avoiding the appearance, at least, of giving a direct answer to *his "anonymous" assailant. To serve this purpose he has conjured up ("in the mind's eye, Horatio") a pair of ladies from Bath*, to reiterate (in a private letter) the objection (already raised in print in the *Mechanics' Magazine*) against his plan of carrying on all the traffic on which the shopkeepers under the railway are to depend, at a height of 22 feet above their heads—in order that when he acknowledges himself to have committed a great oversight, and to have taken others to task for not committing it, he may be spared the mortification of pleading guilty to a charge preferred by his "anonymous" antagonist H. The contrivance is rather a roundabout one, certainly, but it excites a smile, and, at the worst, is no more than a peccadillo.

It is not the same, however, with another clause—that relating to the rental of the arches. On this score, as it will cost me but little trouble to prove, that Mr. Herapath has been guilty of misrepresentation, and one so easily exposed—that it will only be necessary to refer to his own words, in the article which was originally animadverted upon, to prove its character to the satisfaction of all. When I have done this, I trust that both the readers and the Editor of the *Mechanics' Magazine*, will be satisfied that the "sweeping charge of misrepresentation" preferred against Mr. Herapath has been amply confirmed from his own words.

In No. 635, p. 21, we have Mr. Herapath "endeavouring to make himself better understood" as to the rental of the arches, in consequence of the Editor's observation that he had made no provision in his calculations for the capital necessary to convert the arches into habitations—an observation originally thrown out by myself. Now, mark what he says on the matter:—"It was stated that there were reckoned to be about 1,000 arches, which were computed to let at 30*l.* per annum each; but in order to keep within the mark, I took 900, and allowed them at 20*l.* each, thus reducing the rental from 30,000*l.* to 18,000*l.* This I again afterwards reduced to 16,000*l.*, thus *leaving a rental of* 14,000*l.*, *out of which I thought my readers would see that an interest for any capital needed for fitting up those houses might be found.*"

It is scarcely possible to conceive, what is nevertheless the plain truth, that this statement is a complete tissue of misrepresentation; and not only so, but that every reader of the Mechanics' *Magazine* may easily convince himself of the fact, if not from his own memory, at the utmost by referring to vol. xxiii. p. 451, where he will find the following words, constituting the original statement in question, forming part of the 10th Number of a series of papers, "*On Railways. By John Herapath, Esq.*":—

"It is said there will be about 1,000 of them (the arches), which some calculate will fetch 30*l.* per annum each. But suppose only 900 of them let, and at 20*l.* per annum each, the rental will be 18,000*l.* per annum, or 2,000*l.* annually more than the interest of the whole capital at 4 per cent."

Here we have "some" people who calculate on 30,000*l.* while Mr. Herapath, more moderate, takes credit for only 18,000*l.* Not a syllable here—not the most distant hint, to lead any one to conjecture that the 18,000*l.* was a nett sum, produced by a deduction from the 30,000*l.* Hr. Herapath repudiates the 30,000*l.* estimate at once, and *in toto*—and puts forward his own, of 18,000*l.*, *in lieu* of it. "*Some* calculate they will fetch 30*l.* per annum each, but *suppose only* 900 *of them let, and at* 20*l. per annum each*"—well, what then? Why, the produce will be 18,000*l.*—and 18,000 can never be turned into 30,000 by the most practised mathematician on earth. Until such a thing can be done, therefore, I must be permitted to charge Mr. Herapath, if on the ground alone of this glaring discrepancy between what he *really did say* (in vol. xxiii. p. 451), and *his statement* (in vol. xxiv. p. 21), *of what he said* on that occasion—with being guilty of misrepresentation.

Ever yours respectfully,

H.

Nov. 17, 1835.

[We have taken the liberty to omit some expletives in the preceding letter which do not at all affect the *substantive* matters in dispute. Mr. Herapath may possibly be in error; but to insist that he is intentionally so, is a stretch of *liberality* not only needlessly offensive, but, to our minds, wholly uncalled for.—ED. M. M.]

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PRINCIPLES OF RAILWAY LOCOMOTION.

"Who shall decide when Doctors disagree!"

Sir,—By Mr. Herapath's rule it seems, that a carriage with an initial velocity ot 30 miles an hour, will attain a velocity of $31\frac{1}{7}$ by travelling one mile upon an inclined plane with one foot of descent; and by travelling one mile upon an inclined plane with a fall of *sixteen feet, it will attain a velocity of 110 miles.*

Mr. Iver M'Iver, who came forward correct *Mr. Herapath,* and who has since had occasion to correct himself, makes the velocities attained $30\frac{1}{2}$ and $37\frac{1}{10}$ miles per hour. See page 124.

Calculated by the theorems given in Dr. Gregory's "Mathematics for Practical Men," the numbers come out $35\frac{1}{4}$ miles nearly for the first case, and almost 52 miles an hour for the second. It is a pity that men who are liable to commit such blunders have not more discretion than to put themselves forward as teachers.—Your obedient servant,

S. Y.

17, Lambeth Terrace, 16th Nov. 1835.

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GRAY'S RAILWAY SCHEME.

Sir,—The many visionary schemes which disgraced the metropolis in the years 1825 and 6, have bewildered the public, and caused them to pass unqualified censure upon all plans, both good and bad; the share mania, however, like all adventures promoted by unprincipled speculators, must soon work its own cure, and I feel every confidence that the public will shortly return, with redoubled energy, to support my scheme, whose merits are clearly established by long experience and practical knowledge.

Had public attention and the capital of opulent individuals been directed to the unanimous support of this measure, it would not only have opened a field of permanent wealth and industry to all at home, but perhaps it might have also prevented many desperate mining speculations in foreign countries.

A deputation from one of the Railway Companies waited recently upon me; but, after an examination of their map, I did not hesitate to condemn the whole scheme as being too circuitous, and objectionable, besides, on account of several inclined planes and tunnels. They have, however, obtained their Bill.

My incessant application to this subject gives me confidence to forewarn Companies against any and every deviation from the perfectly direct and level line,* as I am persuaded in my own mind, that no engineer, who understands mechanical power, would recommend any other course on lines of communication where the business or intercourse demands at all the adoption of a railway.

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* A "direct" line must, of course, be always the shortest between any two principal towns, but where there are a number of secondary towns by the way, which it is desirable to accommodate, there will seldom be any thing, in a general view of matters, gained by following such a line; for according to the number of branches necessary to connect the wayside towns with the main branch, and the length of these branch lines, must the total number of miles of railway be considered as increased. Nor, in point of mechanical power, is any thing lost by a winding line, as long as there are no curves of greater radius than half a mile.

It will, most assuredly, answer the private views of engineers, mechanics, and others employed in manufacturing various descriptions of machinery, to recommend tunnels, inclined planes, stationary steam-engines, and the application of the most costly works; but, on the other hand, it behoves the public to reflect upon adopting the least expensive and most efficient plan—that which will cost the least in annual repairs, and, at the same time, be the most simple, convenient, and economical for daily intercourse. A multiplicity of machinery is the great evil to be avoided; and experience teaches us, that the daily expense may be diminished in proportion as the power is simplified and concentrated.

Through ignorance, or design, our *civil* engineers are following a course which cannot fail to answer their interest, although unprofitable to the community, as, from every palpable error they commit, they still draw freely upon the credulity and folly of the public, who as freely *praise* and *pay* them for their bungling works!

Whatever railways may be made from London to the north, I do not intend to be cajoled out of my London and Edinburgh Grand Trunk Railway, in a perfectly *level* and *direct line*, and in defiance of all opposition. Nothing could contribute more to the wealth and prosperity of the two capitals than the establishment of this Grand Trunk. The vast traffic which might be drawn into this channel, throughout the whole extent, must be so obvious to all persons who are acquainted with the general commerce of the country, as to render a detail thereof quite unnecessary. The whole of the Scotch and Irish trade—the coal trade of the north, and all the inland collieries—the corn, iron, lead, glass, timber, stone, fish, cattle, and every other trade—and the manufacturers from the numerous districts through which the Grand Trunk might either pass or be immediately connected by branches—could not fail to render the undertaking nationally important, and highly lucrative to every individual subscriber. No expense which might be incurred by forming this Grand Trunk in a direct and level line could be felt, when we contemplate the millions of tons of merchandise, as well as innumerable vehicles for the daily conveyance of passengers in both directions, which this improved method of internal communication would annually circulate through the very heart of the kingdom. The incredible amount of revenue which might annually be derived would, on an impartia investigation, far outweigh all consideration of the first cost of the construction of this Grand Trunk Railway.

My respectful compliments to Mr. Herapath, and I beg to inform him that I look upon myself as the Father of the railway scheme, and upon the Civil Engineers as very undutiful children. I have some rods in pickle for each of them! As Railway Companies are now forming for various districts, I certainly do hope that I may obtain an appointment as Secretary, for I feel particularly anxious to be employed in furtherance of my darling scheme, in any manner most conducive to the public welfare. Surely he who planted the vineyard must be entitled to partake of its fruit.

Believe me, Sir,

Yours very respectfully,

THOMAS GRAY,

Author of "Observations on a General Iron Railway."

Exeter, Oct. 8, 1835.

CULTIVATION OF THE VINE.

I was naturally much interested by some comments of Mr. Hayward (present vol. *Mechanics' Magazine*, p. 10) on the culture of the vine, it being a subject to which I have recently devoted much attention. My expectations were highly raised by Mr. Hayward's exordium, in which he advocates the importance of the application of *science* to horticulture. "It is an axiom," he says, "that every production of nature and of art is the effect of some cause; consequently, before any effect can be produced, the cause must be established, and before any effect can be prevented, the cause must be removed; and before *any* person can undertake with any certainty, to establish or remove the cause of any effect, they must know what i

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Dr. Lardner has shown, further, in his evidence on the Great Western Railway, which we published *some time ago in our pages, that there may be cases in which even a "level" line has nothing to boast of over one, all up and down,* from beginning to end.—*Ed. M. M.*

is; and a knowledge of the causes of effects is science."

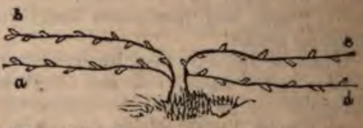
Now for Mr. Hayward's application of a "knowledge of the causes of effects," to the culture of the vine.

He begins by laying down certain axioms, one of which I consider so completely erroneous, that I lose no time in attempting to refute it. Mr. Hayward says, "The greatest quantity and finest quality of fruit will always be produced on those branches that are at the greatest distance from the root." Here is one of the most general and pervading errors that is the chief cause of disappointment in attempting to cultivate the vine in the open air. If Mr. Hayward be right, he will have finer fruit at ten feet from the vine than at five, and finer at twenty feet than at ten, and finer at forty than at twenty. Did Mr. Hayward ever try how far the shoot of a vine can run before it reaches perfection? And will he favour us with an account of the peculiar improvement it has acquired at each stage of its travels? I grant, that, in the illustrations he has given, his practice is a great deal better than his theory; but he must see that what I have stated is only a fair deduction from his axiom. It would seem as if the generality of cultivators were thoroughly imbued with the truth of this assertion; for the object seems to be to make the vine extend itself as far as possible over the wall, in hopes, I suppose, of ultimately attaining that distance that will bring its produce to perfection.

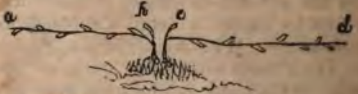
Now, if any one of my readers has a vine that has been treated in this manner, and is dissatisfied with his want of success in procuring, with any certainty, a well-ripened crop of fine grapes, let me entreat him to try a totally different system. Being aware, with Mr. Hayward, that, "before any effect can be prevented the cause must be removed; and before any person can undertake, with any certainty, to remove the cause of any effect, they must know what it is;" my friend will set his wits to work to remove the disagreeable effect of his having no grapes worth eating. He will remember that the wood of the vine which has once borne fruit never bears again; and that the energies of the tree have been expended in the *immense mass of useless wood under which it is groaning*, instead of being directed to the growth of the delicious fruit for which he planted it. If the object had been to procure firewood, nothing could have been more judicious than the old system; year after year the sap has deposited along the branches a layer of alburnum, which ultimately becomes converted into heartwood; year after year, the centre of the tree has been more and more occupied by wood of this description, and it has been only at the extremities that the tree has produced at all.

Having now discovered "the cause of the effect," let us undertake to remove it; and I hope that I shall not be considered too violent a Radical Reformer if I recommend that the tree be cut down six inches from the ground, the incision seared with a hot iron, and well covered with sealing-wax. The following spring, several shoots will push from the stump, four of which only should be retained; and, instead of being worthless twigs, these will be as thick as a man's thumb, and, if they have not been shaded, every bud, except the two lowest, may be depended upon to produce fruit.

Let it be trained in this way :—



The following winter, having ascertained from Mr. Hoare's scale* the quantity of fruit the vine ought to bear, according to the circumference of the stem, the shoots *a* and *d* should be shortened to the requisite length, and *b* and *c* to one bud each, when the vine will present the following appearance:—



The next summer, if the requisite attention has been paid to the different points of culture (which are explained in Mr. Hoare's treatise in so clear a manner that the uninitiated cannot blunder), finer fruit will be produced at five feet from the root than before at fifty. While the fruit has been maturing on the shoots *a* and *d*, two shoots will have pushed from the spurs *b* and *c*; these are to be the fruit-bearers for next year; and as the wood in *a* and *d*, which has once born fruit, will never bear again, it is now an incumbrance to the vine, and must be got rid of; it must therefore be cut out at one bud from the stem, and will be replaced by shoots to become the future bearers.

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* One of the most valuable guides to the practical horticulturist, who, from this scale, the result of long experience, can at once decide upon the fruit-bearing capabilities of the vine, and prune with confidence.

Having now got a considerable insight into the "causes of effects," let us proceed to lay down an axiom totally the reverse of Mr. Hayward's. THE TRUE ART OF CULTIVATING THE VINE CONSISTS IN LEAVING A DUE PROPORTION OF FRUIT-BUDS ON THE SMALLEST POSSIBLE QUANTITY OF OLD WOOD.

I have always thought that disquisitions on the cultivation of fruit were much improved by an opportunity of tasting it; and as, I doubt not, the editor will be of the same opinion, I have begged friend Clement to send some of his branches, collected as near the root as possible. Should Mr. Hayward think proper, let him send some of his at twenty, forty, or fifty yards from the root, if he chooses, and from the editor's well-known impartiality and readiness to listen to both sides of an argument, I feel convinced that his stomach, like his pages, will be open to the reception of any exquisite reasons Mr. Hayward may have to offer.

I have just received the enclosed remarks with the fruit, and am,

Very respectfully,
HENRY WATSON.

Chichester, 11th mo., 13th, 1835.

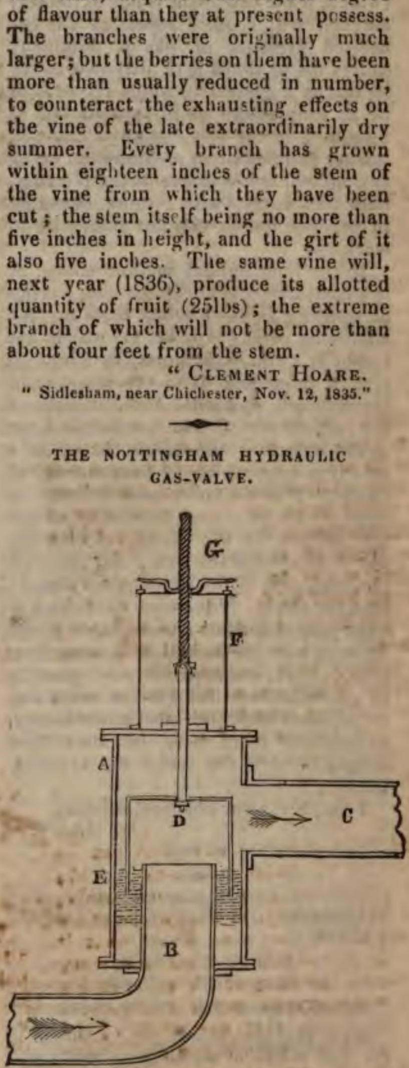
The editor has to thank Mr. Watson and his friend Mr. Hoare for a very handsome present of a box of grapes, which accompanied the preceding communication. The grapes are of a larger size and of a more exquisite flavour than any grown in the open air in England, which he ever before tasted; indeed, he had no idea that such fruit could be raised in this country, except under cover—they are equal to the best hot-house grapes. The following explanatory remarks are from the pen of Mr. Hoare himself, of the great advantage of *whose judicious mode of culture, there can hardly, we presume, be any doubt:—*

"These grapes, which are of the sort called Black Hamburgh, have been produced on the open wall, without the slightest artificial aid whatever. If protected from heavy rains and severe frosts, they would hang well on the vine for two months yet to come; and would, during that time, acquire a far higher degree of flavour than they at present possess. The branches were originally much larger; but the berries on them have been more than usually reduced in number, to counteract the exhausting effects on the vine of the late extraordinarily dry summer. Every branch has grown within eighteen inches of the stem of the vine from which they have been cut; the stem itself being no more than five inches in height, and the girt of it also five inches. The same vine will, next year (1836), produce its allotted quantity of fruit (25lbs); the extreme branch of which will not be more than about four feet from the stem.

"CLEMENT HOARE.

"Sidlesham, near Chichester, Nov. 12, 1835."

THE NOTTINGHAM HYDRAULIC GAS-VALVE.



Sir,—The water gas-valve, described by Mr. Peter Horsman in No. 638 of your Magazine, I consider can be esteemed but second-rate, when compared with Mr. Carter's, which I think superior to most of the latest improved valves. The inconvenience which the valve eulogised by Mr. Horsman must occasion, and the time expended in emptying and refilling it with water (which, if the attendant is not extremely careful, will require repeating till the desired pressure of gas is obtained), causes me to think it of little worth for its use as a gas-valve, which requires to be as simple and as little complex as possible, in its application. The following description of an hydraulic valve, two of which are in use at the Nottingham Gas-works, will, I think, be found in practice much simpler and easier to work :—

In the longitudinal section above, A is a cast iron cylindrical vessel, having an opening in its bottom plate for the admission of a gas main B, which has round it a rim with holes, to admit of screws to connect it to the vessel, and is continued upwards till a little above the surface of the water, which is kept in the vessel at the height E. D is a cast iron cup, which covers the top of the pipe B like a hood, but when drawn upwards by means of the screw G above the surface of the water, suffers the gas to flow from the gasometer through the inlet pipe B, and along the pipe C, into the town. The screw G (which is kept perpendicular by means of frame F) may have its threads cut to any fineness desired; consequently, the quantity of gas admitted through the valve can be adjusted with the most exact nicety, as nothing more need be done than simply turning the screw the requisite number of times.

I am, Sir, your obedient servant,

A. Y.

Nottingham, Nov. 10, 1835.

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SELECT COMMITTEE OF THE HOUSE OF COMMONS ON ARTS AND MANUFACTURES.

MINUTES OF EVIDENCE.

(Continued from last Number.)

James Morrison, Esq., M. P., examined:

Have you ever turned your attention to the best means of encouraging this knowledge of art among our manufacturers; would *you think it* advisable to establish central *schools in London, or* provincial schools?—I *think a public school in* London is, in the first place, absolutely necessary. After persons shall have been prepared to teach, there ought to be similar institutions in the large manufacturing towns.

Do you think that in London they would have greater facilities for acquiring information on all those branches of art connected with the manufactures; London being the emporium of art, as it were, there would be greater opportunities for artists of every description to learn that which was applicable to that branch of the manufactures which they intended to pursue?—No doubt of it.

Are you aware that at Berlin they have schools of that kind; that the principal school of art as connected with manufactures is in Berlin, and that there are provincial institutions existing also separately from those in Berlin?—I have understood such to be the case, but I have never been at Berlin.

Have you not been so much impressed with the propriety of encouraging such institutions, that you yourself have taken an active part in trying to encourage the establishment of them?—I have felt so much the want of such institutions, especially since the discussions on the subject of free trade and the admission of foreign manufactures, knowing our inferiority was altogether in the art of design, that seeing the thing was not done, I have myself offered to assist in the establishment in London of a school of art connected with manufacture.

In fact, you were so convinced of the beneficial effect it would have, that you offered to make a very considerable advance yourself to assist that object, did you not?—I did.

And several other gentlemen, and many eminent persons, and among others Lord Brougham, took an interest in the question, did they not?—Lord Brougham has always taken great interest in it, and something I imagine would have been done, but for the expectation that Parliament would have adopted some measure.

You have, of course, turned your attention to the means of encouraging manufactures, by opening to the eyes of the people, galleries, collections of casts, in fact, giving them every opportunity of instructing their minds in art, and creating a desire for art, by the observation of that which is beautiful?—Undoubtedly, it is most desirable that they should be encouraged to visit such institutions; and I very much regret that the British Museum and the National Gallery are closed on those days upon which it is the most convenient for the labouring classes sometimes to attend.

Do you think that sufficient attention has been paid to what may be called the education of the eyes of the people by our own Government, or has it been as much attended to as that species of education has been attended to abroad; that is, by freely opening galleries to encourage and increase the taste of the people?—I think it is a very extraordinary circumstance that, whilst in small states, where there are scarcely any manufactures, one hears of schools of design, yet in this country, at the head of the manufactures of the world, and where it would be of the most importance, we have nothing of the kind.

Have you ever considered how far the Government should interpose in the encouragement both of institutions like open galleries and instruction connected with the education of artists?—It is rather difficult to say how far the Government should interfere. If the public could be induced to interfere, they would do it generally better without the Government than with it. But I think Government in this case, as in the case of the National and British and Foreign Schools, might grant a certain sum of money in aid of local subscriptions.

You think they might superintend and interpose without unduly interfering?—I think they might assist in the establishment of such an institution, and, when established, it might afterwards support itself.

You think it is of sufficient importance to be made a national object, do you?—I think it is at its commencement. I think also, that the extension and improvement of our national works of art, would be a very wise use of the public money.

Are you aware that in France the Government assists the municipalities in the formation of such institutions?—I have so understood.

Are the Committee to infer from what you have said, that there is no want of talent in the country, but that there is a want of encouragement for the application of art to the purposes of the manufactures?—There is clearly no want of talent, because in those branches of art which are encouraged, I think we are decidedly superior to other nations.

Have you had an opportunity of considering the want of protection for inventions of patterns and designs, both in tissue goods and also in metal works, in this country?—I think the want of protection is, in all cases, an immense check to the progress of the arts of design.

The question has reference to the want of protection in the patent right?—There can be no want of encouragement on the part of the public, because all the manufacturers allow that if they produce very superior articles, however expensive they may be, there are parties ready to purchase them. The reason why they do not produce more and better, and why they do not encourage artists to follow that as a profession, is that their patterns, if good, are immediately pirated.

Do you think it desirable that the law should give a better protection to the original inventor of these designs than it does at present?—I think a protection for a limited period, sufficiently long to encourage the manufacturer to make the outlay of his money in the first instance, avoiding, as far as it is possible, the confusion which would arise from a great number of persons claiming the right in similar patterns, as they must resemble each other. I think that is the sort of protection that should be given. It should in many cases, I think, be limited to a season, say six months; in other cases perhaps a period of one, or two, or three years might be necessary.

Do you not think that there has been a great in the production of this country, though you think that there has been no improvement in art as applied to manufactures?—There has been a very decided improvement, so much so, that the best articles manufactured before we had imported the manufactures of the continent, would, in some branches, be now quite unsaleable.

Do you think that that improvement is merely an improvement of foreign articles, or is it creative to a certain extent?—It is generally imitative.

You think there is a growing demand for manufactures in which the arts of design are best exhibited?—Undoubtedly.

Do you think that the taste of the country is so improved, that articles which were current and fashionable articles some years ago could not now be sold?—Yes, but that fact may arise from various causes.

Does not the fashionable taste in itself require a better system of art; that is, is the fashionable taste improved?—Undoubtedly.

Have you not had occasion yourself frequently to suggest improvements to British manufacturers?—I have had occasion not perhaps to suggest any particular improvement, but I have urged upon them from time to time the necessity of making improvements generally, and of improving the quality and style of their goods.

Do you find any particular disposition on the part of our manufacturers to spend money for the purpose of the application of art to their manufactures?—I hear on all sides their objection that they are not protected, and that if they were to expend money on patterns, they would only be doing it for the benefit of others.

Are you aware that in some of the manufactures of France in which art is most expensively applied, that the absolute outlay of capital is ten per cent. upon the production?—I am not aware of the exact proportion, but I know it is very considerable.

Is there not a class of individuals in France who are a sort of consulting manufacturing professors, persons to whom the manufacturers are in the habit of applying with reference to the formation of colours?—I believe there is.

Do not you think that such a class of persons would be very desirable in England? —Most desirable.

Is not Clement Desormes one of those persons?—Yes.

If there were a class of intelligent chemical professors, such as Clement Desormes and others, who were habitually consulted by manufacturers as to the means of improving colours, and the application and advantage of chemical arts to manufactures, do not you think that would be exceedingly useful?—Yes; at present the manufacturer does not employ artists to design, for the reasons I have given, and probably for the same reason he does not lay out his money in chemical skill.

Do not you think that the ignorance among manufacturers as to art generally has been a great impediment to the introduction of chemical knowledge in the manufacturing field?—There is no doubt of that. But I should say that that is owing to the deficiency of scientific education among the middle classes, in which France, it is generally understood, is so superior to us. I should also state, that the new colours, as well as the new patterns, originate in France. We have a vast number of colours now in our manufactures which were quite unknown a few years ago, and there is scarcely one of them which has not been originally imported from France; that, however, is partly owing to the fact that the fashions are set there.

Did you ever hear an expression of surprise from the French manufacturers as to the great superiority of our manufactures, as far as regards the mechanical skill, and our great inferiority in the chemical arts and the arts of design?—I have frequently heard such an expression.

The system in France in most cases is this, is it not, that the central government shall allocate out of the general fund a certain sum for the schools of art, and the municipalities should furnish the deficiency?—Yes.

Do you think that would be convenient in this country?—I think it would, at least in the commencement; but I doubt whether it would be necessary to permanently continue any annual allowance to them.

As far as your observation goes, do you not believe that the principal manufacturing towns have a strong feeling on this subject, and would be willing to co-operate in it?—I believe they have a very strong feeling, although it has not been expressed to Parliament very strongly before; but this is mainly owing, I suspect, to the hope they have clung to of getting foreign manufactures in some branches again prohibited.

Are you aware whether they have represented in any petition to Parliament, with respect to our manufactures, that they are inferior in pattern and design to the French manufactures?—I have seen it stated in a petition from Foleshill, near Coventry, where the ribbon trade is extensively carried on, that they are deficient in that respect only, and praying for some encouragement or assistance.

Are you aware that funds have been lately raised in the town of Nottingham for the special purpose of establishing a school of art?—I have not heard of that.

Are you aware that the Mechanics' Institutions in different towns have devoted a certain portion of their funds for the encouragement of art and the encouragement of design?—I am aware of it, but I have doubts whether in the present state of things in this country they would find persons competent to teach them.

Is there not at present on the part of the manufacturers a much greater disposition to acknowledge their inferiority than existed some years ago?—I think there is, and indeed it would be impossible for them to deny it, because they all copy from the French.

As the honourable Member has stated that he thinks it important that the invention of patterns should be protected, could he suggest to the Committee any machinery by which that object could be accomplished?—The only mode which has occurred to me is that of copyright, depositing a model or pattern of the article to be protected in some public office.

You do not think that the exceedingly cumbrous machinery of the Patent-office could be applied to the protection of patterns where the value of the copyright is so transitory? —I am not acquainted, in detail, with the mode of transacting business at the Patent-office.

One of the most important results to obtain is rapidity in the recognition of the right, and economy in obtaining themonopoly of it; is not that so?—Yes, and for that purpose it appears to me that we want some sort of tribunal which should abjudicate upon questions of that sort.

Do you not think that local tribunals, composed of masters and men, might be conveniently and usefully introduced for the protection of patterns?—For all matters connected with disputes about wages, and the good or bad workmanship of the operatives, I think a union of the masters and men would be very desirable; but I do not see in questions relating to rights of patterns, which are questions between master and master, that the introduction of the labourer is necessary, or that it would be convenient.

But if the labourers were intelligent labourers, and instructed as you propose to instruct them by schools of art, would they not be important persons to whom questions as to the valuation of copyrights might be referred?—I think they would be very good witnesses as to what was or what was not an infringement of a patent; but I am afraid that some years must elapse before we could see them sufficiently well educated, either in art or general education, to act as judges on the subject.

Did you ever hear it stated by French manufacturers that they have received important suggestions for the improvement of patterns from the hand loom weavers?—I have, and I recollect a circumstance which was mentioned to me some years ago at Paisley, which showed in a very striking manner the advantages derived from the superior education of the working-classes in Scotland; a manufacturer there showed me a piece of goods copied from a French pattern that he had put to work; the weaver, after making one or two pieces, applied to him and suggested an improvement, by which the wages were reduced 25 per cent. upon the manufacture of the article; and I would observe that that article was one with which we came into competition with the French manufacture in our market.

Do you not think that the inferiority of our English artists is in some degree owing to the want of demand by the public for those improvements in manufactures?—Certainly not; on the contrary, the public very willingly give very high prices for foreign articles, and they would, I have no doubt, purchase English manufactures at the same prices, if we possessed similar excellence in art.

Do you think that their taste is concerned in the preference, or do they not very often select from foreign articles those articles which are inferior in point of art, though they may be for the moment attractive in point of fashion?—I very much doubt whether that preference is given for foreign articles, merely because they are foreign; I think the public are always ready to purchase our own goods when they are really equal to foreign.

Do you not think that if foreign articles evince a superior degree of taste, they are immediately preferred in this country as well as abroad?—Undoubtedly.

You think that in proportion as you extend the taste of the community, that of course there would be a greater demand for those articles in which taste is evinced?—Certainly.

The great mass of the community in this country, not merely the lower and the middling classes, but a great portion of the upper classes, have not had their taste proportionately cultivated, in proportion to their education; is not that the fact?—I believe that that is the case.

Do you think that that arises from the want of opportunities for the cultivation of that taste, such as the deficiency of public institutions, libraries, and museums, and public galleries, or do you think it arises from the neglect which is shown to that department of education during the course of their studies at college and at school?—Much is owing to the want of what may be called elementary education at schools and colleges, but it is chiefly because fine examples of art are not constantly before their eyes; a kind of education that is perfected in rather an adult age.

Did you not find on the continent, particularly in Italy, even among those classes that have had very little previous education, and also in schools or colleges, there prevails a general feeling for the arts, and that they with pleasure frequent galleries and public institutions which are open to them by the munificence either of government or individuals?—I have been merely a traveller in Italy, not a resident there; but one cannot even pass through a town without being struck with the regard and respect they entertain for art, and the great love they have for it.

If public galleries and public institutions and public museums were open more generally to all classes of people in this country, you think that a very strong feeling for art would be gradually generated, do you not?—I think it is already generated to a great extent in this country among the upper classes, and we owe much to those gentlemen who have supplied the exhibition at the British Institution from year to year; the National Gallery has been very beneficial, and the improvement of our street architecture has also been very useful.

Do you see that improvement in taste evinced not only in the capital, but in other parts of the empire?—Undoubtedly. In the course of some recent visits which I have paid to different parts of the country, I have been very much struck with the improvement in our provincial towns.

Would you have the goodness to state some of the instances that have come under your observation, in which that improvement has been the most remarkable?—Birmingham and Liverpool particularly.

Do you think that in order to disseminate generally a feeling for the arts among the middle and lower classes, one of the first essentials would be cultivating to a more considerable degree that taste in the higher classes during their college education?—It may be doubted whether Oxford or Cambridge ever can become a good place for the study of the fine arts.

In order to diffuse this love of art among the middling classes, would you not recommend that the cultivation of drawing, for instance, should form, to a certain degree, a portion of their education?—Undoubtedly; the use of the pencil cannot be introduced too early.

Would you extend that to elementary education; to elementary schools, that every child should learn a certain portion of drawing?—I think that might be useful, and it would be the more readily ingrafted hereafter in the systems of our popular schools, but I doubt if we are prepared for it at present.

You are aware that it has been introduced in Germany and in Switzerland, are you not?—I have understood so.

Do you suppose that there is any thing so distinct in our organization from that of other countries, that would preclude its introduction from our elementary schools?—I should say, on the contrary, it is better suited to a dense population and a great manufacturing people.

Would it entail any additional expense in education, the introducing of such a system?—I should answer not, if our teachers had themselves been educated for the purpose.

Is it not your opinion, that it would be an excellent thing both for the artist and the consumer of works of art, to make art to a certain extent a part of elementary national education?—I should say it would be very desirable, and especially in our manufacturing towns, but until we have schools where teachers may be formed, it would be impossible, I think, to commence a thing of that kind with effect.

Is it not the fact, that some time ago French papers were introduced to a great extent?—Certainly.

And has not that introduction diminished since our artists copied their patterns; that is, with respect to paper-hanging?—That I have no doubt is the case. It is certainly the case in most of our printed articles, that as our taste improves, so does that of our manufacturers, and there is less demand for foreign productions.

Are you aware that the importation has diminished since the patterns previously introduced have come to be copied in England?—I have no doubt that such must have been the case, although I have not particularly inquired about it. But I should say generally as to manufactures with which I am better acquainted, that our manufactures have gradually supplanted one foreign article after another, till now the importations are confined merely to the novelties of the season, and these, as soon as our manufacturers copy them, cease to yield a profit upon the importation.

Are there not a great number of branches of art connected with modelling, where a degree of education is required?—Undoubtedly.

And therefore it is impossible that in those branches of art, without giving the education, we should have the benefit of the designs of other countries?—Certainly.

Does it not require a degree of previous education to appreciate the beauties of the higher branches of art?—Unquestionably.

Therefore is it not your opinion that an uneducated man sent into a gallery of works of the higher orders of art would be incapable of appreciating them?—Undoubtedly; in the higher branches of art.

Therefore the establishment of museums and galleries would not be sufficient to effect that purpose, but it would only be an accessory; is not that the case?—It certainly, alone, would not produce that effect; but as there must be much talent for art existing, such exhibitions produce, perhaps insensibly, very considerable effects; they operate, directly or indirectly on the public mind, and I have no doubt diffuse benefits through all the different grades of society.

Can you inform the Committee whether in that species of education which has been alluded to, modelling would not be a very important part, as well as drawing?—It is absolutely necessary; and I understand partly to supply that want, that in the institute of British architects they propose to establish an institution of that kind.

Are you aware of the fact, that the *formatore* in this country are, without any exception, foreigners?—I have understood that foreigners are generally employed in casting figures; whether there are any English or not, I do not know; but I believe that we are very much indebted to Italians for the diffusion of a taste for art among the middle and lower classes.

Do not you think that the style which now prevails, and has lately prevailed a good deal in this country, which is called the Louis Quatorze style, that a good deal of its success is attributable to the want of skill in our designers?—I do; and whilst I think it is an evidence of the disposition on the part of those who have the means to expend their money on such articles, I think it probable that they would have spent the same money upon what may be considered a better style, if they had had the opportunity afforded them.

Do not you see a general preference given by the upper orders to that style of art, even when they may select from either Gothic or Greek specimens, that they still prefer the style of Louis Quatorze?—I think that that is a fashion which is passing away.

You stated that you observed a considerable improvement in the taste displayed in our public buildings in the streets?—I did.

Do you think that that taste has been well directed?—I should offer an opinion upon that subject with a great deal of hesitation; I should say it has not; but undoubtedly it has produced an effect very superior to what existed before.

Do you consider that it is quite unnecessary that those people high in authority who have the superintendence of those buildings, should know any thing of the art which they are called upon to direct; do you not think that it would be an advantage rather that those people high in authority who have the direction of those monuments, should know something of the art that they are called upon to preside over?—I think it very important that we should have responsible public officers to take charge of our public buildings; that supposes, of course, persons duly qualified.

Thomas James, Esq., examined:

The fabrics that I am best acquainted with in our house are silk manufactures; with respect to colour, ever since the introduction of French goods, I think we have had a very considerable improvement in the colours, and in the patterns of the English silk manufacture, particularly in the colours—not only in the plainer, which may be called prismatic colours, but in those colours which are creations of fancy, the shades have been much more brilliant than we used to have them. The importation of French silks has almost entirely ceased in consequence of this improvement. The power of producing finer colours on the part of our manufacturers has increased, — as also there has been an increased degree of good taste in appreciating the colours. This improvement has been perceptible since the more free intercourse with France. Referring to Manchester and Macclesfield, the time the country manufacturers came to London to attend the periodical sales of silk at the East India House, it was their custom to come to our house and other houses of our class, and obtain from us patterns of the shades of different French goods that we had bought or imported, and the imitation of these goods and patterns has led to these improvements, or at least has been co-existent with it. From the excellence and beauty of our fabric, if silk was still to advance and become dearer, *the public would always repay* that by an increased consumption. The difficulty of selling a bad shade of colour, whenever it does occur, is increased considerably on account of the general appreciation of good colours. Until the last two or three years, the production and consumption of figured British silks was a mere trifle, but within the last year the production and consumption of British figured silks has been very considerable. The figures are smaller, and I think more beautiful in form than formerly. Combining the beauty of design with a certain degree of neatness as well in tint as in colour, the silk manufactured in England has materially improved. Formerly they were most apprehensive of the figured silks from France, and the contest in them was thought hopeless, but there is now executing in Spitalfields a considerable order for figured silks for America, where, of course, they must meet the French under no circumstances of protecting duty. If, then, the beauty of English manufactured silk goods is so materially improved, from our manufacturers having the opportunity of seeing the French, there is a still greater capability of improvement if more means of improvement were placed within their reach. I think a matter of the first importance would be to give to the parties who originate patterns a property in the patterns for such a length of time as would repay the outlay and encourage the production of patterns. The Committee is aware that such a protection is given to the printer. When a pattern is framed on printed cotton, the party is protected by the law in the exclusive right of the pattern for three months, and I would suggest that protection should also be given to patterns framed in the loom. It will be in the recollection of the Committee, that some years ago an India handkerchief was almost the distinguishing mark of a gentleman; every gentleman had one in his pocket. India-printed handkerchiefs of very common patterns were sold at from 7*s.* to 10*s.* a-piece; now the great consumption of India handkerchiefs is by the importation of the unprinted cloth, and they are printed in this country with English patterns, but the cloths printed in India are now principally sold by hawkers to the lower class of consumers. In our figured patterns we borrow very largely from the French. It is very desirable that we should create an original taste here; we are still behind the French in ribbons and shawls; we borrow our figured patterns from France in a principal degree. From the decided advantage that we have from China silk and our application of China silk, I do not fear that we shall decidedly beat the French in figured as in plain goods. I have heard that the French Government sent a mission some few years ago into the region of

Cachmere, both to introduce Cachmere goods, and also to speculate on the production of the Cachmere shawls.

Mr. Thomas Field Gibson, examined :

I am a silk-manufacturer in Spitalfields. The description of figured silks which we are now making in Spitalfields are of a very small and insignificant kind; they are not of the large class of patterns. That is the general class of patterns that are now making. They are almost entirely copies or variations from French patterns; there is but a very small degree of talent employed in Spitalfields in the production of patterns. We are almost destitute of original taste in that particular department. The French patterns are generally given to the pattern-makers by the manufacturers, and they either copy precisely, or make variations as the manufacturers, or their own taste may suggest. I am not acquainted with any drawer of patterns who is an educated artist. A good pattern-drawer may obtain from 100*l*. to 200*l*. a year; but the remuneration varies with the description of pattern. It is also mixed up with a remuneration given for reducing the design to the mould, or cutting the card, which is necessary for the weaving it in the looms. I think that the two difficulties under which we labour at present, are, first, that we have no protection for patterns, so that if I make an outlay of from 20*l*. to 100*l*. upon a pattern, it may be pirated to-morrow by my neighbour, and I should have no compensation for it; and the second difficulty is, that we have no national taste in this department of art, that we have no originality in design in drawing of patterns, that we are compelled to make copies from French patterns in order to supply the demands of our customers. I think a school of arts open to persons connected with the manufacture of the country would be of high value and importance, coupled with the protection of patterns; but without a protection of patterns, no school of design would be of any advantage to us. It is not to be expected that the master-manufacturers would undertake any part of the expense of such an establishment. The utmost that could be expected from them would be to give their time and attention to the arrangement and working of the system; and I believe the fact is, that in France the Government, or the municipal authorities, or both together, do pay for the whole cost of the establishment. If the general taste of the nation was improved, it would be beneficial to our manufactures; and I would add, that ours is a manufacture which is capable of such extreme variety in shades of colour, in the blending of shades, and in producing various forms of pattern, that there is hardly any one to which the exhibition of all works of art in which colours are concerned would be more beneficial. A protection for patterns should be for not less than twelve months. I can give a reason why a season or six months would not be a sufficient time. I was manufacturing a pattern in silk during the spring, to the order of a large house of business in London. I received orders from them to continue the manufacture of the same pattern in autumn colours; but in the last month this pattern was taken to Manchester and manufactured there. The order which I had received for the winter article was immediately countermanded, because it was produced at Manchester at a much less price. A heavy fine should be inflicted for piracy. Sometimes there are more than 100 pieces of the same pattern. It more often happens that there are less than 100; more often than not. According to the average returns from the Chamber of Commerce at Lyons, the number of pieces made of fancy goods of particular patterns does not exceed 20 from the frame; what is the average production of England of the same manufacture, I have no precise knowledge of—but I should say double, at least 40. In French silks in some cases a very large profit is paid to manufacturers on condition that they shall produce a small number, and then destroy the design. A pattern should be protected by registering the actual pattern. With regard to printed goods, the custom is for the parties to print on the end, "engaged for three months," and after that period it may be copied by any body; that would be a sufficient protection if it was extended, as I said before, to twelve months—whatever registration took place should be a public and authentic one. The registration and location of patterns, representing the state of protection in the particular trade, would be in itself a great means of advancing and improving the manufacture. There are no superior weavers solely employed in weaving patterns, and there is a good reason why this is so; a weaver could not himself produce the pattern to the manufacturer in the same way as he does at Lyons, because in London he is not possessed of machinery by which he could do it; the machinery belongs to the master-manufacturer here, but in Lyons it belongs to the weaver. I have heard that in France after the design has been produced, the weaver introduces a considerable modification into the pattern itself.

Mr. John Howell (of the firm of Howell and James, Regent-street), examined :

The manner of choosing our patterns or goods is as follows: it is usual for the Lyons manufacturers to come twice a year to England, that is, in the spring for the autumn, and the autumn for the spring, and they produce perhaps 200 or 300 patterns, not paper patterns, but silk patterns or gauze patterns, or whatever it may be, and from these patterns we make our selection; and it sometimes happens that we have so good an opinion of certain patterns, that we say, "Now you must withdraw that, it must be made for us only," and for 20 or 30 pieces they will do that. Now the English manufacturers never give us that advantage, they think it very expensive to put to work a pattern to show us the effect of it, for it looks so different on paper to what it is in reality, that we cannot decide whether we shall have it or not, and we often urge them to bring us a little piece ready, to see the effect of it; sometimes we want colour, sometimes we want a little change in the disposition; but there has always been an objection to the expense incurred, and therefore we are obliged to bear the expense if we are content to order from a paper pattern; we have sometimes found it necessary to ask for a pattern-drawer or designer; not a pattern-drawer, because they are distinct businesses. I never found a good designer in England; a pattern-drawer is a different thing altogether; he is the man who puts the thing comparatively to work, as an architect designs the building of a house. Neither have I found a good pattern-drawer; the designer gives us a small pattern, and the pattern-drawer is the person who prepares the work; as an architect gives a drawing to the builder, so does the designer to the pattern-drawer. I think there are not so many persons that are capable of doing it in this country as in France; the pattern-drawer is the medium between the designer and the weaver. After the Peace with France, I found the manufactures of France were superior to those of England; I mean in regard to silks of all descriptions; but I think a great deal of that arose out of having made use of better material; the natural silk of France has been considered better than any other country, but now we have an importation of that natural silk, and it is manufactured here. The importation of raw silk from France, by reason of its superior quality, has beneficially acted upon the English manufacture; I found their silks better the moment I had an opportunity to go and see them; but I have found them declining every day since; every time I go to France, I find the French silks are not so good as they used to be in point of material and workmanship; they appear to be desirous of a large trade rather than a small good trade; the English manufacture has improved in a greater ratio perhaps since then. France is superior to us in design; but it is confined to very few houses; there is only one house at Lyons we can deal with largely, because their taste is always superior I am speaking of design. We keep all our patterns; patterns fifty years old are very useful to us at this present moment. The French pay great attention to pattern shawls; they will give three or four hundred pounds for a Cachmere shawl, or India shawl, for the sake of the pattern. The shawls that were exhibited at the Exposition in France were superior to the India shawls; the patterns more perfect. Their patterns are superior in the manufacture, as well as the combination of colours and design. It is all superior. I believe they have a superiority of machinery in the manufacture, and execution as well. Will the Committee allow me to exhibit some pieces of paper, to elucidate the connexion between silk and other materials, the manufactures of the country? It shows how the introduction of good patterns will give a taste or style to other materials; it is intended for rooms in lieu of silks; and instead of costing two guineas and a half, a yard would only cost 2*s.* 6*d.* The inventors are De la Rue and Company, Bunhill-row. — [*Mr. Howell then produced to the Committee patterns of various colours.*]

Mr. Robert Harrison, examined:

In designs and patterns in the silk trade we are very inferior to the French; and that is the principal difficulty under which we labour at the present time. We have not been able to find persons in this country who are capable of giving proper designs; the principal difficulty arises from the circumstance of men not having been brought up in this country to design for silk; it is very different to designing for printers, from the circumstance that it is necessary a man should be conversant with the principle of weaving before he can make a proper design for silk. If we could only get designs in this country, we should be able to find parties that could put them on ruled paper for weaving. There is nothing but what we could make, provided we had a proper designer for the purpose of drawing patterns for weaving; and I think the principal difficulty arises from the circumstance of not having any school of art in this country, where young men would be enabled to pursue their studies for the purpose of perfecting themselves in drawing for that particular branch of the manufacture. There is no want of talent in the country, because there are a great many persons engaged exclusively in the production of designs for printed cottons, challis, and bandannas; we have in the trade individuals who can draw patterns, but are not conversant with the principle of weaving, and therefore we have been unable to put those patterns to work. We have now many patterns by us which are perfectly useless, because the drawing is not adapted to weaving. We would willingly, at the present time, engage a man at a handsome salary, conversant with the principle of weaving, as a designer, and also able to put the pattern upon paper. Foreigners are not superior to us in their colours; there is a brightness in their colours we certainly do not possess, but I think our colurs are more permanent. The dying of colours has certainly improved within the last few years, and in many cases, the permanency of colours decidedly is more so than the French. It is necessary to have a perfect chemical knowledge before a man can be a good dyer. I understand the peculiar brilliancy of the French colours arises from the climate more than any thing else, and the water has something to do with it as well. It has occurred to me, if we had a school of arts established in this country, that a great many young men would be willing to make themselves conversant with the principle of weaving, for the purpose of procuring that particular study, and ultimately to become designers and drawers upon ruled paper for the silk trade. It would be a lucrative profession.

Mr. George Eld, Mayor of Coventry, examined :

In consequence of the public attention having been directed to the subject, I made some inquiry with a view to ascertain the number of persons engaged in the ribbon trade, and who had any knowledge of the art of designing in Foleshill; with a population of 7,000, I could not find more than six persons in the whole parish who were capable of copying a pattern, and not one capable of making an original design. At Coventry there is a drawing class connected with the Mechanics' Institution of that town, but it is as yet quite in its infancy. The inhabitants of Foleshill presented a petition to Parliament, in which they prayed for assistance towards establishing a school of design as connected with the ribbon manufacture. I think the operative weavers would eagerly avail themselves of such means of improving their taste and knowledge of art, if those means could be afforded; and I may mention as an instance of that, that I was conversing one day with a weaver in Foleshill, and stating to him my wish to see the establishment of some school of design in that neighbourhood; he said it would be a good thing, and the next morning his nephew waited upon me; he said his uncle had mentioned our conversation to him, and he very much wished that something of the sort should be established. He brought with him some patterns which he had made himself, and was anxious that I should assist in setting on foot something of the sort in Foleshill; a register of patterns; or, in short, to establish a school of design. A mere drawing school would be of very little use, unless it was accompanied by lectures on the art of drawing and design, as applicable to manufactures, and as showing the means of transfenring the design to the article to be produced.

Are you aware, that, at present, new patterns are invented at Coventry and at Foleshill?—I think very few original patterns are invented; but not being a manufacturer myself, I cannot speak very accurately to that.

You have stated that there is a conviction on the part of the operative weavers that such establishments would be of utility to them?—Yes.

There is a willingness therefore on their part to improve their taste and to acquire a greater knowledge of the arts?—Certainly.

Do you conceive there is any want of native talent, if properly encouraged?—None at all.

In fact, then, in your opinion, it is only doing justice to the natural talents of the manufacturing population to give them the means of acquiring a better knowledge of the art of design?—Certainly.

Do you think, if some encouragement were given by Government, or by Parliament, for the establishment of schools of art in certain districts, that local assistance might also be obtained for the same object?—Yes, I think so, certainly.

You think there would be no unwillingness to assist, on the part of the inhabitants of those districts?—I think there would be great willingness.

Have you any public collection of pictures at Coventry or Foleshill? — No, there is none at Coventry, and Foleshill is a mere village, with very few opulent inhabitants.

Then the manufacturing artist has no external means of acquiring a taste in the art of painting?—No.

Is there any museum for patterns at Coventry?—No.

Or of machines?—No.

Is botany a study at all attended to by the manufacturing weavers?—No; there are some collections of natural history, principally of birds, at Coventry; but I have not heard that they have turned their attention to botany at all.

Have they any means of acquiring a knowledge of the effect of a combination of colours?—No.

Is chemistry a science which is at all attended to by the operative weavers?—No.

Is it not attended to by the dyers?—I do not know.

In your opinion is there a sufficient number of opulent inhabitants in Foleshill to establish institutions to promote instruction in the arts among the manufacturing population?—At Coventry, I think, very material assistance could be derived, not only from the opulent inhabitants, but from the established school of that place. There is a school called Bablake School, which is under the patronage of the corporation, in which I think drawing and design, as applicable to manufactures, might very easily be introduced. I think the funds at the disposal of Government would very much assist, with the aid of the local institutions, such as Bablake School, in which, if the boys could be taught the arts connected with the occupations in which they are afterwards to be engaged, it would be very advantageous. A central school of art for the instruction of teachers would be very useful, as it would provide for a general direction of the schools. The instructors, taught in London, from the circumstances of the immensity of the population, the number of public galleries, and the habitual intercourse that exists among individuals of all nations, would certainly have superior facilities for acquiring knowledge in all branches of art.

Mr. Robert Butt, of the Bronze and Porcelain Department, at Messrs. Howell and James, examined:

I consider, that, with a few exceptions, in metallic manufactures the French are vastly superior to us in their designs. The exceptions to which I allude are more particularly to manufactures in silver, to gold, jewellery, and to castings in iron, in which I think we excel them in design. In some branches of the porcelain manufacture the French are superior to us in design, in others they are inferior. In that description of porcelain which is of the same nature as the old Dresden china, ornamented with raised flowers, we are vastly superior to them, and a considerable quantity of such porcelain is, I believe, annually exported to Paris, and is sold there, and considered by the French superior to their own; but with the exception of porcelain in which the designs are in relief, theirs are superior to ours. The French are superior to us in their designs in bronzes, and some other metallic manufactures. In the term "bronze," we include not only that which is strictly bronze, but all articles cast in similar metal, whether gilt, or-molu, or otherwise, such as human figures, figures of animals, and the ornaments of clocks, candelabra, and so on. The superiority of the English in the one case, and the superiority of the French in the other, is accounted for by the superior costliness of the articles to which I *allude in England, as compared with those of France, enabling* English manufacturers to give high prices to artists to model or design their patterns, particularly in silver; but with respect to articles of an inferior value, the French are superior to us in their designs, from the greater cheapness of art in that country. In the less costly articles for which art cannot be so highly paid, there is not a sufficient supply of art at a cheap rate for the purposes of the manufacturer. For instance, a silversmith who pays highly for a design, and produces a very costly article, could afford to go to a Flaxman or a Stothard, as artists who could furnish a design; but the manufacturer of articles which come within the range of the less opulent classes of consumers could not afford to employ them. Articles in bronze are of sufficient importance to require the employment of able designers, yet they are not of sufficient importance to demand the assistance of art to be paid for at the same rate as it is for manufactures in silver and such costly materials. I mean particularly to allude to the richer description of silver articles manufactured in England. But similar designs for bronze may be obtained at a much lower rate in France. The reason the iron manufactures will pay for the employment of able designers, and those in bronze will not, is because castings in iron, such as I allude to, that is for architectural embellishment, have a very extensive sale in this country, and we have no foreign competitors in that branch of manufacture, but for bronzes there is not an extensive sale, and we have the competition of the French to contend with. I attribute the general excellence of the French in the design of manufactures to the facilities afforded to persons of all classes in France for acquiring a knowledge of the art of design, and the corresponding difficulty to any but persons of comparative independence of obtaining similar instruction in England. The advantage which arises to the French workman from that knowledge of the art of design which the public institutions of France enable him to obtain, consists in the circumstance that he is thereby enabled frequently to make his own designs and models, and if not sufficiently instructed to do that, he is at all events enabled to finish works executed from the models of others with superior accuracy, so as to give them their proper articulation and feeling, particularly in human figures and figures of animals. I may say, in continuation, that this is rarely the case with English workmen; and the advantages which the former consequently possesses, are conspicuous in the beautiful figures which decorate the clocks, candelabra, vases, &c. which are imported from the Continent, the grace and expression of which (however well modelled by the artist) would be entirely spoiled by an injudicious finishing of the muscles, draperies and extremities by an ignorant workman. Independently of the workmen being instructed, the manufacturer is enabled to get models of great beauty executed at a reasonable rate, which is one of the causes of the great abundance of beautiful designs in France. I am inclined to think that the opportunities which the French have of studying the arts must give a certain tone and feeling for them throughout the country; but I do not know that any superiority in that respect exists among the middle class of France as compared with the same class in England. With respect to the upper classes, I do not think the arts can be appreciated in any country more fully than they are in England. There are very good works in silver filagree executed in this country; as good as Spanish or American, but inferior to the Indian. There is no considerable importation of silver filagree-work for sale. With respect to Germany, the natives are inferior to the French in design, as inferior as we are, or more so, with the exception of the iron-works at Berlin. For putting the English manufacturer on an equal footing with the French, I would recommend the establishment of schools of design on a popular plan, which shall be entirely separate and distinct in constitution and management from any of the academies of painting and sculpture now existing in England; and in which it should be distinctly understood that the system of instruction to be pursued would not be intended to qualify the pupils for the professions of painting or sculpture, but merely to teach them the arts of designing and modelling with purity and taste, to be afterwards applied to any manufactures which they may themselves practise, or for the direction of the works of others. Such schools would operate to improve the manufacturing artist, by enabling young men to acquire a sufficient knowledge of the art of design, to qualify them for the double capacity of clerks and draftsmen or modellers in the counting-houses of manufacturers, who would thereby be enabled frequently to vary and improve the designs of their manufactures without much cost; the great expense of models and drawings by artists being one of the causes of the paucity of design in their patterns at present. I would observe here, that a parallel system obtains in the offices of architects and engineers, where young men are constantly employed in the capacity of clerks and draftsmen. Having gone through a certain probationary study, they are admitted as articled clerks until they acquire a thorough knowledge of their art, and after a certain time receive payment for their services. It would also enable apprentices in certain trades to acquire a knowledge of design, by agreement in their indentures to attend so many times per week at these schools, so that the study of the manipulation of their trades and the art of design might go hand-in-hand and bring both to perfection. I believe that this system is practised in France. The process by which a knowledge of the arts of painting and sculpture is now acquired in England is this: a young man receives tuition from a private master; he draws from the antique at the British Museum for a certain time, and when he shows that he has sufficient talent to qualify him for a student of the Royal Academy he is admitted; but the expense of acquiring that preliminary knowledge is considerable, and the young artist must also be maintained by his relatives during the time that he is acquiring it. Open exhibitions of the finest works of all sorts in stone, paintings, bronze, and so on, would have a good effect on manufacturing artists, as giving specimens of the highest works of art. Every school ought to have its museum, the expense of the formation of which would not be great, for casts from the antique statues, busts, vases, candelabra, gems, coins, and so on, would answer the purpose very well. Such a museum ought to be open to the public under certain limitations, to prevent their interfering with the studies of the scholars. There can be no doubt that it would be of the greatest benefit to the manufactures of this country by improving the taste of minor artists and workmen. The Acts of Parliament existing, for the security of copyright, as far as I know, on the subject of copyright in models or casts from models. afford protection to a certain extent, but the objection is, that they do not go far enough; the protection afforded by the law to models or casts in bronze and other metals extends only to such designs as represent human figures, or figures of animals, or part or parts of such figures. I may state, for example, that however beautiful the design may be, if it be merely a model of *Arabesque* scrolls or foliage of any description introduced into any work, such as clocks, candelabra, &c., there is no protection for it; it may be pirated with impunity.

The copyright in articles which the law now protects, is, in the first place, for a term of fourteen years, and for a further term of fourteen years in case the inventor be still living at the expiration of the first term, and has not sold his copyright. That is the law at present under the Acts of the 38 George III. chapter 71, and the 54 George III. chapter 56. By the last Act the protection given by the 38 George III. to models of human figures or of animals, was extended to human figures clothed in drapery or otherwise, and combinations of the human figure with parts of the figures of animals, and also to any subject being matter of invention in sculpture. It is very difficult to ascertain the true construction to be put upon the words "being matter of invention in sculpture," but my opinion is that they would not extend to guarantee the copyright of any model of scroll work, &c. cast in metal, as in the instance of the iron gates of the royal entrance to Buckingham Palace at Hyde Park Corner, which are remarkably beautiful. Now I apprehend that if casts or impressions were to be clandestinely taken from those gates, and another pair similar in all respects, but with the omission of the royal arms, were to be thereby made and sold, and the proprietors of the model were to bring an action for the piracy, it would be contended that there was no copyright in the design, as it would not consist of models of any part of the human figure or the figure of animals. Moreover, as it could be easily proved that the models of those gates were originally made in wax, clay, or some plastic material, and then cast by the founder in iron, it would be held that there was no sculpture in the matter, and that therefore they could not come within the meaning of the words "matter of invention in sculpture." They might be imitated, provided the King's Arms, which of course contains representations of animals, were omitted. This imperfection of the law applies to the proprietor of the model, whether he be the artist, or whether he has purchased it from the artist. By the copyright of a model is of course understood the exclusive privilege of making copies or casts from that model, which a manufacturer may purchase from the artist. The inventor of models which come within the Acts of Parliament as representing human figures or figures of animals, is, I think, sufficiently protected by the present law. I do not consider that the present copyright is for too long a period with a view to afford the inventor a fair protection, and at the same time with a view to the interests of the public, because articles of the nature of which I have been speaking do not sell rapidly; at first the manufacturer will sell but few, and it is only when they become known that he is repaid for his outlay. In respect to plans for recording new designs and models in England, I would suggest that offices of registration or depositories of original designs should be established in the principal towns of the kingdom, where artists or proprietors of new models should deposit a correct drawing or copy of that model, accompanied with a declaration or affidavit of the artist or proprietor, that it is really a new model, and is his property. With respect to the stamps or marks on castings, taken from those models, *the plan now* adopted under *the Act of Parliament is to stamp* the name of the proprietor and the date in every such casting previously to publication for sale; but this mode is extremely inconvenient, and it would be a great disfigurement for small castings of figures, or otherwise, to have so large a stamp as would be required on them. It would, I think, answer the purpose better if to every drawing deposited a number were attached at the office; and that the manufacturer should be required to stamp his article with that number, and a letter which should stand for the name of the town in which it was registered, as A might be London; B, Manchester; C, Birmingham, and so on; a kind of index; and by using the letters of the alphabet in the Roman, Italian, and English characters, and those doubled by taking the capital and small letters, we should have 124 towns, many more than would be required for registration in the kingdom. In order to facilitate the understanding of these marks, it would be essential to the public that a key to the letters, that is, a list of towns and their distinguishing characters, should be exhibited in some public part of every office of registration. By that arrangement it would be easy to ascertain whether the models were really registered or not, which would be necessary to prevent persons from stamping their works without taking the trouble to register them, and from passing off copies of old models as new and original ones. A mode of registration exists in France, by depositing drawings of models, but I believe the other part of the plan I have stated is new. The numbering and the alphabetical key to the register is my own idea. A provision ought to be made to protect the copyright of models in cases not of an exact copy, but of so near an imitation that one might sell as well as the other; for instance, a figure of Apollo, by altering the posture in the slightest degree, or putting a different drapery upon it. With regard to designs in jewellery, the observation I made as to the additional costliness of articles of silver extend also to jewellery; in England, our designs in jewellery are superior to the French designs. In this case the manufacturer is frequently his own designer. I attribute the superiority of the English in designs of jewellery to the superior encouragement afforded in England to the manufacture of expensive articles in gold jewellery. In imitative jewellery, however, the French excel us, for there is greater encouragement in France for the inferior classes of ornaments than there is for the real; the propriety of the distinction that I draw between the qualities of the real and imitative jewellery of the two countries may be inferred from the circumstance, that immense quantities of gilt jewellery are annually imported from France and but little or none in gold.

Mr. Charles Harriott Smith, Sculptor of Architectural Ornaments, examined:

My profession relates to the decoration of buildings; the exterior in stone, and the interior in marble; particularly such work as that about the exterior of the new National Gallery, on which I am now occupied; it is that particular department which I principally profess. The capitals and other ornaments, small monuments for churches, ornamented chimney-pieces, &c. There is no difficulty in finding useful assistants, provided I can afford to give them a fair remuneration. The ordinary wages of a clever person, according to his abilities, about 2*l*. or 3*l*. per week. I design myself, but I work a great deal under the direction of architects from their designs. There are no national schools where students can obtain instruction; a few private academies. I have always found workmen who can draw, if ever so little, are more useful and have the preference. I was going to mention a case in point that recently occurred to me; I sent my foreman into Yorkshire with work; on his arrival he found difficulties arose which he had not, nor had I anticipated, and by letter to me, illustrated by his sketches, he explained all that I could wish for. No one but a man conversant with drawings could have done that; similar circumstances are likely to occur to any man in business; and such men obtain in consequence higher wages. The workmen have gradually improved, which I attribute to good practice and emulation among themselves; also, the opportunity of seeing works of art, and the opportunity of practising upon works that are likely to improve them. The public demand for architectural ornaments increases, especially in my department. We are most deficient in the true spirit of the Gothic or old English style of carving; but what is strictly called architectural ornaments are more particularly a mechanical process, such as Corinthian and other capitals, friezes of regular proportional parts, &c.; but where trophies, draperies, and those sorts of things occur, they become more decidedly connected with the fine arts. The workmen are, of course, less skilful in that branch than the mere execution of the mechanical part, such as the capitals of Corinthian columns, because it approaches nearer to a work of fine art, and hence becomes more difficult to execute. Wages increase pretty much in the proportion in which the operative is removed from mechanical labour towards the production of art; those branches that are purely mechanical and depend much on accuracy of measurement, such as the execution of Corinthian capitals, are done by ingenious common workmen, if I may so term them; when they are employed on work nearly approaching to fine art, which requires more study and mental comprehension, of course the men have better practice, and if they succeed they demand higher wages, and are entitled to it. I think, that simply in consequence of the improved habits of artisans in my branch of art, it is desirable to give them further means of improvement, since their tendency is to a greater degree of refinement, and that they deserve encouragement by instruction, and opening public places of resort, where they will be made familiar with works of art. I have heard them express a wish to that effect. I have frequently heard them complain of impediments in the way of seeing works of art; and that the museums and exhibitions are not opened after their working hours, and that they have no opportunity of going to them, without not only having to pay for admission, but to lose their time, and of course it thus costs them much more than it does persons in easier circumstances. I think it would be desirable that those collections of works of art, whose influence upon the labouring population would be so beneficial, should be accessible to them at times when they could be visited without any great pecuniary sacrifice on their part. I have always considered that the best means of serving the industrious classes, is to increase their means of serving themselves. I have visited most of the museums in France, and I do not think them superior in designing. The French are more aware of the importance of employing artists to design for their manufactures than the English are. What I have observed as to the comparative merits of the same description of works in the two countries, is this; I think ornaments are as well designed in England as in any country, but the French workmen, collectively, are better educated in art than the English workmen; consequently the French artist has a greater facility of getting his designs well executed than the English artist. The French people, as a body, seem not to be so satisfied with inferior performances as the English are. Whatever deficiency of taste is displayed in our manufactures, arises not so much from want of taste in artists to design and in our workmen to execute, as it does from want of study and education in the arts among proprietors and conductors of establishments wherein classical design and execution forms an important feature. I am also of opinion, that the public, as a body, are not yet sufficiently educated in the arts to discriminate between pure classical elegance and meretricious finery. I am alluding to the public as a body in this country; and the dealers' study is not so much to improve the taste of the public, as to discover what goods will sell most readily, and produce them the largest profit. To mention instances in which our manufacturers giving employment to artists—Coade and Sealey, the artificial stone-manufacturers, formerly employed some of our most eminent sculptors; among others, the elder Bacon, and Rossi; Rundle and Bridge, the silversmiths, used to employ Flaxman, Stothard, Theed, and Baily, all of whom were eminent in the arts, to design and model for them. Wedgewood used to employ artists of eminence also. At the time they employed these artists they were doing an amazing portion of business. From what cause I do not say, but most of those establishments have changed their system of employing artists of eminence, and they have since employed inferior artists, of course at a much less expense. Whether that is the cause or not, I cannot undertake to say, but their business has certainly fallen off very much; they have now comparatively little or no business of any kind wherein the highest class of artists had been engaged, and the plan appeared to produce the most beneficial results to the proprietors. Works of art are not sufficiently protected, especially those departments of art which are more immediately connected with our manufactures; I mean that which I profess. There is a constant piracy going on, and in my own practice I may allude to it more particularly. It is impossible to protect myself sufficiently from it. Any original drawings or models, whenever I am out of the way, are liable, by workmen or others, to be pirated, and I have no remedy beyond that of discharging an otherwise valuable workman. The copyright of the sculptor, the 38 and 54 of George III. is understood in general not to include ornamental works of architecture; but if a case were to be tried, it would very likely take in all classes of sculpture; but the chance of recovering is too doubtful and expensive. I believe it never has been tried.

George Foggo, Esq., Historical Painter, examined:

I have been repeatedly employed to design for the application of my art to bronze and silver. That manufacture now in England is exceedingly depressed; principally, I should suppose, in consequence of the want of copyright, on which account the French have very greatly surpassed us. In England at the present moment the uncertainty of recovering in cases of a piracy, and the great expense attending a lawsuit, make it almost impossible for any but men of great capital to undertake such works at all. When they are undertaken, as the sale is exceedingly limited, those articles are almost universally converted into silver. In France, in consequence of the cheaper law and the greater facility of recovery, a much greater proportion of works of that nature are cast in bronze. So doubtful is the recovery, and so great the expense attending it, that where otherwise 50 guineas would be expended on a design, not more than 5*l*. would now be ventured by the silversmith. As, for instance, in one case where the amount to be expended on a piece of plate was 800*l*. I received 8 guineas for the design. In other cases, where the finished work would amount to 200 or 300 guineas, the utmost the silversmith could spend upon the design has been less than 5*l*. If the copyright could enable the undertaker of such works to spread them to the amount of 20 or 30, he could then afford ten times more on the design, employing none but the best artists, and rewarding them liberally. The main advantage of the copyright in France depends on the circumstance of the cheap law. I was lately in court in a case where the sale of spurious works was most clearly proved. The expenses, I was informed, amounted to 100*l*. and the award for the sale of five different and distinct prints was 15*l*. From what I recollect of such cases in Paris, I should say that the expense would have been under 15*l*., and the award might have been 100*l*. It is, therefore, in France worth while (particularly when we consider the certainty of recovery) for a man of talent to claim his protection; it would not be so in London. Bronze and silver are the same kind of manufacture, I should say: in most instances, bronze is first cast for the sake of the silver plate; that was the case with the celebrated Achilles' shield, by Flaxman. The original shield in bronze, most elaborately and beautifully finished, could not have been sold for much less, if any thing less, than the silver-gilt. But the taste is so much in favour of the more costly metal, that no one would give 3,000 guineas for the bronze, when they could get the silver-gilt for 4,000 guineas, although the value of the silver be not above 250*l*.; and I should say decidedly the bronze was most valuable; and I apprehend the taste of the public in that respect is deficient, inasmuch as gold and silver, having what I should term a positive colour, are less applicable to the works of art than bronze, and still more particularly marble. In bronze it is more a work of casting. In fine works it is afterwards wrought up with great nicety by the chiseller; in the above case Mr. Pitts, a very celebrated artist, was employed for that purpose. With respect to the mode of protecting inventions and designs in bronze, I think, if it were worth the while of a man of talent to claim his protection, it would be best carried out. according to our habits, by special juries, but under the present system this is much too expensive. By special jury, I mean a board of persons conversant with art, but subject like our juries to a challenge. Something like a *cour de prud' hommes*, or a board of competent arbitration, but doubt whether it would be right for them all to be artists. I also think that the period of the duration of copyright should be in proportion to the talent displayed and the importance of the object. Some cases might not deserve three months' protection, others would require 50 years. Some things deserve also to be better protected than others, in consequence of the great facility of copying them. All works that can be cast in plaster particularly require protection; for that which has cost the labour of months or years and vast expense, may be re-produced by the plagiarist in a few hours. Such circumstances prevent the application of first-rate talent to any such productions. In a great measure, the protection should depend on the talent of the artist. I consider that it would be for the interest of the public, for instance in a very beautiful work, that such a board or special jury should have the power of proposing, on the part of the public, to the artist, that his design should be bought up; but I have a very strong objection to the consideration of the interest of the public being paramount. The circumstance of the Americans giving to their citizens an exclusive privilege of copyright, takes away all energy and exertion from those citizens. It has become scarcely worth while for an American to produce a work of talent, when the bookseller can get them from abroad for the price of a single copy. The French are superior to us in the accuracy of execution of their work, but not equal in fancy and imagination; I have myself been employed to design for a work that has been sent over to France to be executed, and the execution was exceedingly correct. I should speak rather in favour of their execution and knowledge than their taste; for works in metal we still prefer that of the early period of Louis XIV. as more free and effective. I attribute the superiority of the French in correctness of drawing to the various schools of design established in every principal town, but more particularly in Paris; there schools are so various, that I do not think that any but a resident in Paris can fully understand the relative difference; they consist of the Royal Academy and the Government school of drawing; of private schools under an eminent artist, and of subscription academies, with no other than mutual instruction. Having resided seventeen years in that capital, and studied in one of their best schools and at the Royal Academy for eight or nine years, I am decidedly of opinion that private schools, under the most eminent masters, are greatly superior to any public establishments. The private schools are the original system *of the instruction in France*, as they were in *Italy during its greatness*. These schools are generally intended for the higher branches of art; but persons who do not evince talent of a high order, naturally fall into the employment of manufacturers. There is one school in Paris for the instruction of artisans employed by manufacturers. Each department has also something like a school of that kind; I am afraid it will be found they produce very little of that which may really be called talent. The national course of instruction for artists in France is very superior to the usual means in England; it consists of private schools, which system bears the most national character of any. Every man of talent, as an artist in France, is supposed to owe much of his reputation to the pupils he produces; his object is to produce men of superior abilities, but the school gets popular, and the system is so well understood, that the number of students becomes very great, and from their superiority they are, when interest does not interfere, appointed teachers in the Government schools, and give a general tone to the talent of the country as far as circumstances admit. The Government schools are very inferior to the others in utility. The private establishments have the spirit of the country in them much more than the Government schools, for the Government schools are founded on one system, and, with one or two exceptions, all follow the same course; they do not fall into the wants of the times and the people so much as the private establishments. I do not mean that they are in name national schools, but they are the schools that give a national character to the French artists; which character is materially checked by the control of Government administration. In France, Government interference in positive instruction is injurious. The encouragement given to art in France is principally from the liberality of exhibitions, and most particularly of the libraries and the museums. The opportunities of study in the libraries and museums are far superior to any thing in this country. I may mention, in proof thereof, that the works of Flaxman, of Mr. Hope, and the publications on Etruscan vases of Sir William Hamilton, were shut up in private collections in England, and produced little effect on the public taste; but being placed in the libraries in Paris and other towns, where not only artists but the public had free access, the knowledge and taste of Flaxman and Hope became there generally appreciated, instead of being, as in England, confined to a few. A fine example of their museums was that of the French monuments, where, in appropriate halls, samples of French statuary of seven successive centuries, afforded an excellent opportunity of studying the taste and the history of the nation. That of mechanical machines is also of great utility. Museums, I apprehend, must be the permanent and all-important sources of taste. Public lectures on the great principles of design and taste may be advantageously added thereto; and from the necessity of the case, another country being so greatly in advance of us in those branches, schools for the instruction of mere outline, and still more of the rules of perspective, would produce very great and beneficial effect. I certainly do think that much advantage would be derived from instruction in the proper simple rules, without shackling the taste; but it appears to me that good taste is so essential to the interests of the community, that museums should be provided at the national expense; but practical skill being an advantage of a more individual nature, ought rather to be paid for (moderately) by the individual. The general taste is decidedly higher in France than in England; but superior taste and imagination more frequent in England. I account for the distinction from this circumstance, I think the arrangements of Louis XIV. and Colbert have placed such fetters on imagination that the utmost that instruction can do in France is to inculcate fixed principles and precision of execution. In the fourth year of the republic, under the Convention, schools of various kinds were instituted. Exhibitions and prizes were also decreed on a liberal scale, but they were ultimately counteracted by the re-establishment of the Academy, similar to Louis XIV., and the occasional injudicious interference of the Emperor. There has been no alteration in the Academy of Arts from 1800 till the present moment,except the exclusion of foreigners from the prizes, and a few minor bye-laws. I conceive that the fixed principles and correctness of execution are all that can be properly conveyed of instruction to an artist. They are all that can be wished for when competition is encouraged; and without free competition art is stifled, therefore it is absolutely essential. With regard to the departmental schools, if the appointments of professors were popular they might do a deal of good; but when I have seen an old man of 62 or 63 appointed to one of those schools, not for the good of his pupils, but to save him from starving, I cannot expect much good therefrom; when I have known in the principal school for the mechanics of Paris, a man of the highest talent, M. Peyron, after 25 or 30 years' exertions in the under professorship, superseded in his claim to the higher professorship by a friend of the Minister, I find a total want of that principle which free competition and proper elections would have carried out. The reason I think superior taste and *imagination more in England, is on account of the restriction* in France, where, being under the Minister of the Interior, all follow one system and routine. In England, competition is created by commerce, which frequently brings a man from the humbler branches of manufacture to the highest stage of art, such as Martin, Muss, Bone, Bacon, and Banks. In fact, the French attempt to teach that which is probably not within the strict limits of teaching, and interfere a great deal too much. The positive, the undeniable, fixed and positive rules of art, such, for instance, as perspective, anatomy, proportion, and perhaps botany, and those things which connect arts with manufactures, in which the principles are undeniable, should, of course, be taught. I think it almost as necessary for a people to possess a knowledge of those points, as to know how to write; I consider it a second way of reading all the beauties and merits of nature. The deficiencies, both in England and France, which still exist, are, first, the deficiency of correctness of perspective, even where correctness of outline is otherwise generally attained; perspective is often little understood in other countries, but is particularly neglected in England. Secondly, a very imperfect knowledge of the history of the arts and of commerce, their effects on each other, and on the state of nations, and thence false theories. The relative influence of the taste of Paris and London, is this, the taste of Paris spreads all over France almost like lightning, while that of London is very much counteracted by the different habits and influences of our commercial towns: for this very reason, museums exactly similar might be established in France without any material injury; but museums in England would be best under the direction of a general board, but modified by the management of men capable of applying them to local purposes. If the town of Liverpool had a museum, it certainly would not, if left to the management of a local board, be similar to a museum in Birmingham or Sheffield, and it would be right that they should not be similar. A knowledge of mineralogy might be exceedingly useful in one town, and perfectly useless in another. Objects of general utility, of general taste, such as fine representations of the most beautiful pieces of sculpture, objects of taste, such as vases and ornamental designs in general, might be exceedingly useful in them all, but each would superadd what was of local interest, in proportion to its connexion with different countries, and the manufactures on which it depended. A local administration should be under a general control, or the control of a general board, in order to prevent local interests from holding too great an influence in the elections, and contracted views in the management; for I am greatly mistaken, if under a well-controlled representative system, the arts are not capable of disseminating knowledge in fifty ways that have never yet been attempted, and I am also strongly impressed with the notion that they should tend to a general improvement of the morals of the people as well as of their intellect. I have no doubt that under a proper general board with local management they would be highly capable of both. Some of our manufactures far excel others in the merit of the designs, and this is usually in proportion to the difficulty of copying them, as the injury of a deficient copyright is therein less felt. I should instance, particularly, the japan manufacture, where the designs are more exquisite than any thing produced abroad. The excellence of a design is partly to be attributed to the difficulty of copying, inasmuch as it is an impediment to the plagiarist, and consequently a protection to the original designer. In the case of the japan manufacture, in consequence of the difficulty of the manual operation itself, the thing is better protected, and I ascribe it partly to the system of encouragement and competition established in the manufactures themselves; the works in japan are, however, conspicuously defective in perspective. I mention this to show, that of all the branches that ought to be taught, that of perspective is one of the first, inasmuch as it is not readily to be obtained. Each manufacturer in the japan trade has his own designers and painters. Designing is not a trade by itself, by which persons get their livelihood, that is, to furnish patterns to the manufacturers of designs in paint, not at least in Birmingham; what there may be in London I am not acquainted with. In that particular line the designs are very superior, but there are inaccuracies from want of instruction. At some interval of time and distance I examined the French and English japan works repeatedly, but not lately; there are no French ones that can at all compare with ours. The French shun the competition, though many individuals in France are anxious to introduce our japan articles into France at present. We have the advantage in both material and design; we are not equal in execution to the Asiatics, but superior in design. Mechanics' Institutions would be so far more beneficial than any school of design, that they would convey to pupils knowledge in chemistry or mechanics or design, according to their natural genius. They would do exceedingly well if you could manage the election of the professors; but in that case a member of an Institution is more likely to be elected than one not a member; it is therefore local talent which gets the influence, which is not so good *as a person confirmed by the* approbation of *a general board.* If the Institutions would agree to be subjected to the decision of a board in London, that much good might be effected. The advantage Mechanics' Institutions would derive from the parent Institution is, they would collect a variety of models, which they cannot now obtain. Therefore, in this country, where you have three or four branches of trade carried on, in Manchester, and in some places almost every branch of trade, you would not confine it to a school of design only, but make it one branch of what would be a drawing class; those who have a taste for chemistry would be good preparers for the materials of printing, and so you would make it useful. Another way might also be easily accomplished, by placing museums under the direction of men capable of communicating instruction.

Samuel Wiley examined:

I belong to the firm of Jennings and Batteridge, of Birmingham, by whom there have been great improvements made in the japan trade of late years; being men of taste, and stimulating their apprentices and teaching them the art of drawing; they have taken great pains. Our men have inserted works of art in the Birmingham Exhibition and other places. Our trade might be increased by improving the public taste; the public taste is bad; I could sell them the worst things, the most unmeaning, in preference to the most splendid designs and the best executions. I could frequently sell bad articles, bad in execution and design, for the same money as I could sell the best. The Chinese adhere to but one style of work exclusively, and that most beautiful in point of execution, but unmeaning as it regards design and perspective; in fact, the designs are very bad. The materials they use I consider one great means of their goods looking so much better than ours; the material they use. Their material after it is laid on, whether it is gold or gold powder, is never varnished, and there is a degree of brilliancy and richness that never appears after it is varnished; we are obliged to varnish ours to preserve its colours, in doing which we lose a great part of its brilliancy. Some years ago we procured gold powder from China, and could make it appear of the same appearance as that from Canton, and we found it very valuable indeed for the purpose of imitating the Indian cabinets and the various articles we have to copy or to repair; but there is a different appearance, as different as possibly can be, between the Indian gold and gold powder, and that of British manufacture; and the material they use for laying on the gold is different; we are informed it is a gum extracted from trees, and when the parts are laid on they are the very same as though you cut small gold wires and laid them in, there is that prominence. There is no trade in this gold powder; we only got it from one person. Accidentally we met with a party who had been an Indian merchant; we found it much cheaper than ours; Mr. Jennings was about making a journey to Canton to procure some himself. I believe the Chinese prohibit the exportation of it from China. I do not know whether the importation is prohibited here; we have applied to various merchants for it; whether it is an article that never comes under their observation we do not know. We have not had it analysed; I think it is prepared by a chemical process, and I think also that it is from the compound that it is better; very likely the metal with which they mix their gold is of a finer quality than ours. The Chinese have a great advantage in their gums. We pay the workmen from 15*s*. to two guineas; in some few exceptions we pay from three to four guineas and a half; one we pay four guineas and a half; the only one; every workman designs his own pattern. A good designer is well encouraged; he is the most valuable man. The French prefer our articles because they are much better in material, workmanship, and design, in characters, beauty, and every thing. They do not seem to raise the japan trade to an art; they appear merely to daub it over and call it japan; there is neither design nor beauty of execution in French work. It is indispensably necessary for a person who designs to be acquainted with the manufacturing branch of the business. Our workmen generally come at twelve or fourteen years of age; if they have previously been taught drawing with perspective, it is a sort of tuition in the other branches; drawing and perspective are essential for them to be taught this afterwards. We teach them first of all drawing and designing, and then manufacturing. The first branch may be learned in London or elsewhere, and the rest in Birmingham.

M. Claude Guillotte, examined:

I am a maker of jacquard looms, and of all sorts of looms for silk manufacture, and of French bar looms, by Premaillerre, upon which (the bar looms) from ten to thirty ribbons at a time may be manufactured, and the whole of the machinery conducted by a young man. Of those, I manufactured 150, at several times, and for several parties; and they were the very first ever introduced to this country, and for which machinery I took out a patent. Jacquard machinery adapts itself to all sorts of tissue. I made three years ago the most complicated machines ever produced in England, with 4,600 threads, at a cost of 50*l*., and before it was put in order and set to use, it cost 100*l*.; it was for weaving napkins and table-cloths, which was all worked by one man. I also made many of the jacquard machines, with 1,600 to 1,700 threads, for smaller table linen. Of late, I am making jacquard machines, by hundreds, for all parts of England, where they had not been introduced before. For Yorkshire, I am particularly engaged at present making them for merinos and damasks, and the same for Bolton and Manchester; I have agents in Manchester, and Bolton district; and I have been engaged in making them at Coventry for ribbon. There are from 7,000 to 8,000 jacquard looms in operation in the country, and there has been an extraordinary increase in the demand; for the silk manufacture, I received in London orders for six, eight, and ten at a time; in Yorkshire, I receive orders for from sixty to eighty at a time; and for worsted manufactures, the demand is also considerable. The demand commenced about eleven years ago, and has become much more active of late in Yorkshire: and yet, I was four years ago in Yorkshire, at Halifax, Huddersfield, and the surrounding country, with an interpreter, taking with me half a dozen, and there was no individual willing to purchase one; and after my return, I received an order for one machine, in order to make an experiment; it succeeded, and the consequence was, an order from the same individual, a Mr. Gill, to manufacture more than a 100 such machines, and there was a demand at any price from every body. These were to replace the old mechanism, which was employed in producing small patterns; those are principally used for waistcoats. The demand could not of course continue so great as it was; but there is still a demand, principally for merinos and damasks. In Scotland I have an agent, but I do not do much, the price of the cards for the manufacture of Scotch shawls being too high. The difficulty of applying these cards to shawl-making is, that for the production of the beautiful pattern, 5,000 or 6,000 are required, which makes it too expensive a machinery. At Norwich, a good many were sold one or two years ago, but they are expensive, and it has prevented its being much applied to the silk manufacture. In Scotland, they use a draw-boy instead of a jacquard to make the figure, to draw the threads that produce the figure on the cloth: in Scotland and Norwich, the number of cards which are necessary for the production of a figure make the employment of jacquard machines much more expensive. Sometimes I employ foreign workmen in the manufacture of my machines, but they leave me when they can better their condition; and a good workman, such as I can employ, will get thirty shillings a week. I think the price is cheaper here than it is in France, and I account for it thus: because I carry on the whole of the manufacture in my own workshops; while in France the production of a jacquard machine is divided among the workshops of several persons. There are only two principal makers here, but the competition between those two is so great that the prices are kept low. Many inexperienced persons have made attempts to make the machines, but have not been able to compete with those who had more experience, and they have failed in producing the article as cheaply as we. I employ about from thirty-eight to forty workmen, all in London. The operation of adapting the design to the loom is this:—First, the design or pattern to be made on the cloth is drawn on paper, and produced for approbation; it exhibits on paper what it is intended to be on the cloth; as the threads are very minute, they are then as it were extended on another paper, the rule-paper, of a larger size, which shows the pattern as it were magnified, so as to place so many threads to the inch, perhaps twenty, so that every square represents a thread. This is what the French call *mise en carte*, and in English, put upon rule-paper. The next process the rule-paper undergoes is, to be read in, which transfers the pattern from the rule-paper, and prepares it fully for the stamping of the cards. The rest of the process is mechanical, consisting of punching holes in the cards, according to the number required, and applying the card to the machine. In this mechanical operation I have seen 200 boys employed in weaving the richest figures in the loom. To so simple a principle is the process of weaving now reduced, that even boys of sixteen are set to weave the figures of so complicated a nature, as formerly would have required men of twenty or thirty years' experience. In some departments of this process, the manufacture is superior in England; in others in France. Plain silks, if manufactured with the same materials, the production will be equal in England as in France; figured silks are equal, as respects the mere manufacture; and there are two points of inferiority, the designing and the *mise en carte*—put in rule-paper. One particular reason for inferiority in England, which has much struck me, is, the very costly price of cards. In the woollen manufacture, the cards which have been used for woollen goods have, as I have observed, been returned to the Excise. A return of duty has been obtained. I think that, if the same thing were done with the jacquard cards, it would have a tendency to diminish the price. Though generally speaking the price is about equal in the two countries; yet in the reading the designs there is this enormous difference; the average price in France is three francs, *or half-a-crown sterling;* in England, the *price was a long time 15s;* it came down to 10*s*., and I now charge 8*s*., per hundred. I attribute that to two causes, the presence of silk manufacturers, which has created a greater competition and a greater necessity for activity. This activity commenced in 1823, but since 1826 the activity and competition were very greatly increased. The consequence of this competition has been also the introduction of a great many French dyers to settle here. The French designer understands the *mise en carte* (putting on rule-paper) better than the English designer; and the French *metteur en carte*, understands design better than the English *metteur en carte*. The great reason that occasions this great difference between the *metteurs en cartes* and designers of England and France, is, that the designers themselves are obliged to put it on the rule-paper, and previous to that go through every branch of the business (including the weaving), and this is undoubtedly the cause that they are more perfect. I do not mean to say that they design better in France than here; but there is a much greater number of designers of the same capabilities in France than here. In consequence of the encouragement the French designers receive, they are as well more numerous as more talented in their science, in common; although there are individuals in England equally as clever, and with a profound knowledge of their art. The artist who draws the designs at Lyons is the artist generally employed to transfer it to the lined paper. This person, whom I consider the *metteur en carte*, is only employed in that; he is inferior here. In Lyons, in a great number of instances, there is never a design drawn at all; but the first production of the design is on the lined paper. The *metteur en carte* is himself an artist. It is in the connexion between the arts and the manufactures that we are inferior. In France a manufacturer employs from three to four artists, and in England one artist supplies eight to ten maufacturers. An indifferent artist employed in painting the patterns on the ruled paper may be obtained for 50*l* a-year, but there are men whose services are worth from 400*l*. a-year, or even a share of the manufacture. The sale of the fancy trade entirely depends upon the taste and abilities of the designer. In France there are often only one or two artists who are paid, and largely paid, who get from 180*l*. to 200*l* a-year, but there are several who give their services for the instruction they receive. The *metteur en carte* ought to be well instructed in designing. He ought to be also well acquainted with manufactures in theory and in principle. They are so at Lyons, but they are not so in this country. The jacquard loom was first adopted at Lyons after the Revolution. Before the invention of the jacquard machine, eight or ten years were required to make a good workman; afterwards six months were sufficient. For ten years after the discovery, the machinery remained with very little influence, but designers increased with the introduction of the machine. From 1808 to 1810 the machine was brought into activity, but at that period it was very imperfect. In 1814 it was much improved, and in 1815 it was fairly established. When France possessed the monopoly of the jacquard machine, it gave her great advantage in other countries; but since it has been introduced into many other countries, France has only by great exertions produced better and cheaper than they. There is a school of design at Lyons. The young artists have since the discovery of jacquard particularly turned their attention to the *mise en carte*. There has been every augmentation of such young artists; indeed, there were no such artists before; for it was found requisite to set up jacquard machines in the school of design. This lasted two or three years only, as they now obtain the required knowledge of the loom out of the school. The discovery of the jacquard loom infinitely multiplied the number of young artists, who devoted themthemselves to the *mise en carte*. The great advantage of jacquard machinery is this, that it enables that to be done in a few weeks, which before occupied months; and that the change of a pattern formerly was a long, laborious, and costly affair, and now it is a very simple one, and may be done in a few minutes after the completion of the reading and the stamping of the cards. In France, in ordinary cases, our artists receive six months' instruction in the theory of the manufacture before they are called into the field of practice, after they have been instructed in the school of design at Lyons; or artists, during their instruction, must pass two hours a day to understand the theory of the application of the design relative to the machine. There are private instructors who give those lessons in the school of design at Lyons; they also give instructions in the *mise en carte*, making their talent practical. The English copy the good French, and the French copy the good English. The best English designs are those in cotton goods; but the English do not understand the *mise en carte*. We sometimes make good copies from English patterns for the Spitalfields looms from the English printed muslins, but it requires taste and knowledge to arrange them. The French manufacturer can come with patterns every year to England, bringing with him patterns on the material; not only designs on paper, but on the material; whilst the English manufacturer only brings it on the paper; the cause of that is, *the French manufacturer employs weavers who are solely engaged in* the production of patterns, and as the pattern on the tissue cloth shows more distinctly the effect than the drawing on paper, it gives them an advantage in the market. There are individuals who are engaged, and who collect at Paris the patterns in vogue there, which they bring and dispose of in England, and they also carry to the continent such patterns as they can collect here for the purpose of sale. These only serve as mere ideas; in the execution of the working drawings the French improve upon us. If there were a school of design established in London, its effects in three years would be so to equalise the manufactures of the two countries, so that the country in which they were produced would not be recognisable. Jacquard machinery is applicable to every fabric, figured or flowered, every thing that can be woven; to every species of tissue to which a loom can be applied, even to straw hats, horse-hair and wire, and every other species of web. The principal difficulties in the way of improvement in the silk manufacture are, first, the high duty on paper. The high price of paper has this injurious effect, that the manufacturer is very unwilling to change his patterns. There is a difference between the cost in France and England; it is as one to four. The English card is superior to the French; but that makes little difference, because it is never worn out, a new pattern being always introduced before the cards are worn. The two disadvantages I consider are these, the higher price of the cards, and the inferiority of the *metteur en carte*. With respect to colours, I think, in a great many cases, where there is an apparently greater beauty in the French dyes, they are much less permanent than those of England, and I have seen many examples where, after a few weeks' wearing, the French colours have wholly faded.

"I take the liberty of making the following few remarks about designing and *mise en carte*; for as this is the very head part of all that belongs to the weaving department, and, at the same time, is the very least cultivated in this country, it is before any thing else the most worthy of your attention and consideration. For as long as this part of the manufactory is not highly improved, and proper schools for design and *mise en carte* erected, and children, who already have acquired the practical and theoretical part of weaving, are engaged and trained up in this art, France will always have to boast over England of the honour of sending more fancy patterns, and finer and more beautiful workmanship, and, in fact, brought to the highest perfection. But, on the contrary, if it should meet with your Honourable Committee's approbation, and get the least encouragement to bring it into fulfilment, and to get such schools erected in some quarter of Spitalfields, or its arrondissement, there is no doubt whatever in a very short time the English manufactures will soon rival, if not altogether equal, the French manufacture, and thus throw off the shame of seeing foreign manufacture surpass the English in quality and superior workmanship.

"Your very humble servant,
"CLAUDE GUILLOTTE."

Mr. John Henning, examined:

Have you been in the habit of executing works in relief for a considerable time?—Yes.

You executed the frieze on the entrance over the gate-way at Hyde Park Corner, and the frieze on the Athenæum?—Yes, in conjunction with my son John, who had contracted with Mr. Burton to do that work in 1827, which was followed by the frieze of the Athenæum, which was a selection from the sculptures of the Parthenon. On both friezes the design was drawn upon the stone, and cut without the usual process of pointing These were our first works of the kind in stone. Previously I had been engaged principally in drawing and modelling, and our first work in intaglio was the sculptures of the Parthenon, which was begun in 1816, and finished in 1822.

Have you ever had occasion to consider the subject of copyright?—Yes, I have; but I have only to tell the Committee of the difficulties which we modellers and sculptors experience; I do not feel that I dare presume to propose a remedy, though I may notice the evils which I have suffered.

State them as clearly as you can?—I have brought a specimen of the frieze of the Parthenon engraved on slate in intaglio; I have also brought a cast of this intaglio in plaster, and another, broken, in the way in which it appears now in the Museum; the intaglio is the matrix from which these casts have been taken; previous to engraving the intaglios, careful drawings were made from the mutilated marble, and the deficiencies were made good to see the effect, and then they were transferred to the slate in the opposite direction, that they might be right when cast.

You were going to state the difficulties which these specimens were to elucidate?—Yes, as soon as the casts are issued, whoever lays their hands on them may, with very little trouble, take moulds in sulphur, wax, or plaster, and multiply them to any number.

You consider that the law does not afford you protection?—There is no protection, as I understand, but in an action at law. The *thing appeared so unmerciful* to me, to lay *hold of a poor man to raise* an action against him, that I never could think of doing that. It struck me that if there was any thing like a committee of art in London that could be appealed to, to identify where a spoliation or theft of this kind had taken place, it might be much cheaper than law.

A species of arbitration committee?—Yes; for any gentleman who knew any thing about it, could detect those thefts readily.

Have you ever thought of the subject of registering such works?—I always have understood by the law, that if you put your name and date it was sufficient, but I think such property as much my own as my clothing, and no one has any more right to appropriate it than to claim my personal labour without remuneration. The originals exist in the Museum, open to all who may desire to make studies from them, without condition, but compliance with the economical arrangements of that institution. This would be fair and honourable strife who could do best; but what hand or heart can contend with the covetous and unjust, who, by the cunning labour of a few days can contrive to rob me of years of life, and scatter over the whole land the deteriorated casts of my works, much to my prejudice as an artist?

All you want is a cheap tribunal?—That is the very thing wanted.

Have you suffered from your own works being infringed upon?—Yes, very much, indeed.

Can you give any remarkable instance?—I had, within the last six months; a man, without giving me his address, wrote to me twice, and put me to the trouble of writing to him; at last I got a third letter, giving particular orders to make them ready. I took it to be some gentleman; at last I found after I had packed them up by a given day, I found he had gone to a person who was in the habit of furnishing people with them, and he never came near me. Nothing would do in that case but an action at law, therefore I preferred rather putting up with the loss.

You submitted silently to the inconvenience rather than encounter another?—I cannot blame anybody for that but myself.

Then he pirated your works in this case?—No, I could not call this piracy, but rather resetting, for he went to the pirate who served him with my stolen goods; but many have pirated them, and continue to do so.

You felt you could only have recourse to an action at law?—I never understood that I had any other recourse than that.

Why had you not?—Because of the expense, and I could not think in my heart of prosecuting a person, probably without a shirt, who perhaps did it from poverty; I could not proceed against him.

You are a self-taught artist?—I do not

know what to answer to this question; however, I have not had any thing like what might be called regular instruction in art. In art, as in every profession, the master, in many cases, can only be considered as the finger-post which points the road the pupil must go on to the place; the pilgrim, creeping or running, must exert himself to the end of his journey, otherwise he will never arrive there.

(To be continued.)

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LONDON AND PORTSMOUTH RAILWAY.

Sir,—Having been much in the company of merchants and manufacturers during a long residence upon the Continent, the subjects that appear in your weekly labours very frequently became the topic of conversation amongst us, being communicated to the members of our Society through the medium of the *Journal Hebdomadaire des Arts et Metiers*, printed at Paris, which appears to draw the greatest part of its information from your pages. The subject of railways was amongst the most interesting, on account of its being thought as necessary and proper a mode for the conveyance of goods and persons, as veins and arteries are to the human body, through which channels the blood circulates to and from the heart. On this subject your valuable Magazine, the contents of which are regularly transfused into the journal here quoted, was found to contain fuller and better information than any other periodical, and, in fact, the only one that entered upon it *con amore*.

I, therefore, address you as the most likely medium of drawing public attention to a plan which has lately attracted my notice—of forming a railway from London to this port, instead of the ship-canal projected some years ago. South Sea Common was then recommended, as I do now recommend it, in case of a railroad being established, as a place where capacious docks and warehouses might be built, and serve as entrepôts for goods coming from all parts of the world to London, or sent from London to be shipped to any foreign market. The metropolis would thus be placed upon an equal footing with Liverpool in facilitating the dispatch of goods, and, consequently, enjoy the benefit of a share in shipments, from which at present *she is entirely* excluded.

The first time I saw an account of railroads, when abroad, was in a book published in London in 1820, by Mr. Thomas Gray, called "Observations on a General Iron Railroad," which, though laughed at and ridiculed at first as visionary, is yearly becoming more popular. The *Journal Hebdomadaire* gives a copy in one of its Numbers of Mr. Gray's map of a general iron railroad, now before me, in which I see he recommends a line from London to Portsmouth; and as there are now railways forming in almost every one of the lines laid down by him in that map, I beg, through your useful periodical, to suggest the adoption of this line also, as the best means of increasing the prosperity of London, by giving it another arm, and making it still more durably the emporium of the world.

You have so frequently admitted articles on railways in your Numbers, that I trust you will not refuse to insert this, on a subject that becomes of more general importance to society every day, and does more honour to the projector, and is likely to confer greater benefit on mankind, than all the victories ever gained by the most renowned warriors in ancient or modern times.

I am, Sir,
Your most obedient servant,
VIATOR.

Portsmouth, Oct. 20, 1835.

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WORKING SHIPS' PUMPS.

Mr. Editor,—Your correspondent, ⊕, on the "Method of freeing a Vessel of Water," states, that various modes have been suggested and patented for taking advantage of a ship's motion through the water for the production of a power to work pumps.

As a knowledge of one or two of the simplest, cheapest, and most easily available of these modes might be useful, perhaps ⊕ will be kind enough to make them known through your valuable medium. Though not desirable perhaps to be brought into general use, there are times when vessels spring leaks that such an assistance to a weak or worn-out crew would be of incalculable benefit. I have often thought the screw of Archimedes offered an easy means of effecting this purpose.

Your obedient servant,
N. G.

Nov. 3, 1835.

NOTES AND NOTICES.

Height of Waves.—Among other proofs of the incorrectness of the assertion, that no waves rise higher than ten feet above the ordinary level, the following vivid description is given :—" During the hurricane experienced to the Northward of Barbadoes by the squadron under the command of the late Admiral De Courcy (in July 29, 1805), the *Centaur*, a seventy-four of the largest class, whilst lying-to, had the small boat (a gig), which was hoisted up at the stern davits, washed away as well as the poop-lantern, by an enormous wave, which was elevated *many feet* above the highest part of the ship's hull, as it rushed past with impetuous velocity; the portion which struck the ship cleared the poop-deck of every thing!—On the evening of the second day, whilst the hull of our shattered and unwieldy vessel lay rolling in the trough of the sea, the cry of one of the look-out men, of 'a ship coming down upon us,' made those who were holding on, under the shelter of the weather-bulwark, spring from their covert to get a peep of the scudding vessel. We jumped upon a carronade, and, with the greatest difficulty, held on, directing our eyes upwards to the position where the stars of the mid-heaven would have been sought for on a calm and clear night! and indistinctly saw a dark object upon the ridge of the towering wave, which was approaching on the weather-quarter. The next minute, a large ship (the *St. George*, 98), dashed close past our stern with a rapidity perfectly astounding; and, before the eye could be well turned to leeward, she was almost out of sight. The danger was imminent, and, but for the providential circumstance of the *St. George's* helmsman catching a momentary glimpse of the *Centaur*, under the foot of the former's foresail, our doom, and theirs too it is probable, had been sealed. One *spoke* of the wheel to port saved us, and barely so, for the giant ninety-eight's proximity was alarmingly close, in her desperate flight before the furious tempest! If any dependence can be placed upon our eyesight in broad daylight—when much of the heightened peril of the storm seemed to have lessened with the departure of the night—and from intent contemplation, for some hours, of the successive *seas* as these came rushing and doubling onwards, as it were, to wipe away with one brush of their curling and foaming, the glorious and inglorious work of man, which lay like a helpless log at their mercy—we would say, that if a horizontal line had been drawn from the apex of the loftiest wave to the ship, it would have intersected the mainmast about half-way up from the deck; which, making allowance for unavoidable error, would give about fifty feet for the elevation of the wave."—*Nautical Magazine.*

Bath and Weymouth Railway —Messrs. Hopkins and Sons, civil engineers, of Plymouth, intend forthwith to produce a prospectus of a railway from Bath to Weymouth, *via Ilchester*, at which latter place there is to be a branch railway to Bridgewater, thereby uniting with that from Bristol to Exeter, and thus forming a communication from Weymouth to Bath and Bristol, which places will be in direct communication by railway with Gloucester, Cheltenham, and Birmingham, as well as Liverpool.—*Jersey Star.*

Dublin and Kingstown Railway. — In eleven months and one week since the opening of this railway, the number of passengers has amounted to one million!

Fribourg Suspension Bridge.—M. Arago, in a paper descriptive of this bridge, read lately to the French Academy, which agrees in all material respects with that contributed some time ago to this Journal by Mr. Terry, C. E. (See vol. xxiii., p. 50); makes the following comparison between it and the *Menai Bridge* :—"*The only bridge which, for its dimensions, can be compared with that of M.* Challey, is the Menai Bridge, built by the late Mr. Telford, and which joins the Isle of Anglesey to England. The largest ships can pass under this bridge at full sail. But the breadth of the Menai Bridge is only 167½ metres, 516 feet—consequently 301 feet less than that of Fribourg. The surface of Mr. Telford's bridge is about 32½ metres, or 100 feet above the level of the sea at high water. That of M. Challey is 51 metres, or 156 feet above the bed of the Sarmi. M. Candolle has taken the city of Paris as a standard, by which to convey an idea of the magnitude of M. Challey's bridge. He supposes a bridge of only one single span, the length of which shall be equal to the railing of the Carousel, or to the distance between the two corresponding carriage entrances of the two galleries, the level of this bridge being somewhat lower than the height of the towers of Notre Dame, or eight metres higher than the column of the Place Vendome, and you may thus have some notion of the height and length of the bridge at Fribourg."

Steam-Engine Work. — A steam-engine, lately erected on a copper-mine in this neighbourhood (St. Austell), has been reported to have raised, at an average rate of performance, upwards of ninety millions of pounds weight one foot high, with a bushel of coals. The correctness of this statement was questioned by rival engineers and others, and so seriously, that a challenge for a public trial was given and accepted. It took place last week, in presence of a number of most experienced mine agents from different parts of the country, and the result of twenty-four hours' trial was the unprecedented performance of lifting 125¼ millions of pounds weight one foot high, with every bushel of coals consumed! The engine is of large size, the cylinder being 80 inches diameter. The principle is that of Boulton and Watt, but improved in economising the heat when generated, so as in the greatest possible degree to apply it to the end of producing steam, and maintaining it until its work is performed. The engineer's name is West.—*Falmouth Packet.*

Mr. Herapath requests us to state, that present avocations of a pressing nature oblige him to defer his reply to Iver M'Iver till next week, or perhaps even a week later,

Mr. Staunton has our thanks. His hints shall be attended to.

Communications received from Mr. H. Brett—Mr. L. Squire—O. H. F.—Mr. Jopling—Philo-Austen.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles Esq., C. E., is just published, price 6*d*. Also, the volume complete, in boards, price 9*s*. 6*d*.

☞ Patents taken out with economy and despatch; Specifications prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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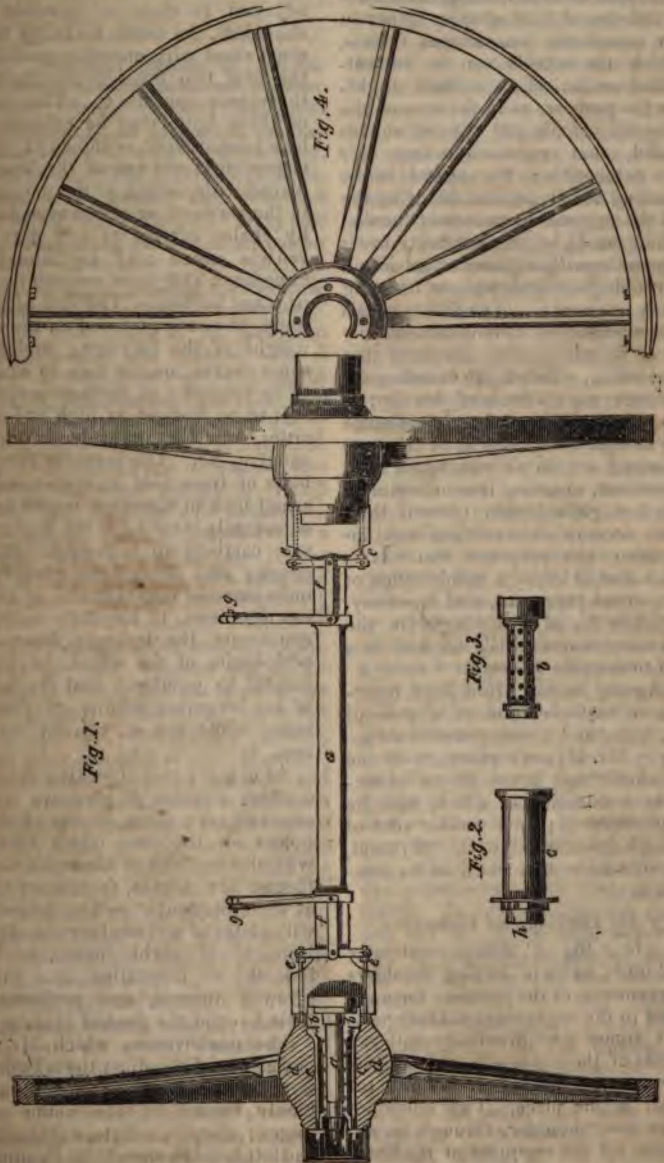
HYNES'S PATENT CARRIAGE-WHEELS, AXLES, AND BOXES.



MR. HYNES'S PATENT IMPROVEMENTS IN CARRIAGE-WHEELS, AXLETREES, AND BOXES.

The improvements comprehended under this patent, divide themselves into two distinct branches. The *first* consists of a method of constructing the wheels and axletrees of carriages, or rather in certain convenient appendages thereto, by which the wheels can be instantly locked or unlocked without alighting for the purpose, as in the case of the ordinary drag-chain and slipper, and so concealed, that externally they are hardly perceptible; the *second* in so constructing the boxes and securing the ends of the axletrees permanently therein, that there shall be an abundant, never failing, and *equally diffused* supply of oil to the rubbing surfaces, without its being necessary as usual to take off the wheels every now and then, to renew the supply of oil, or to remedy the effects of that unequal oiling, which is the besetting sin of all former contrivances of this sort.

The object aimed at by the patentee will be at once recognised as of first-rate importance; nor do we run much risk, we apprehend, in giving it as our opinion, that he has gone further towards their complete accomplishment than any inventor who has preceded him. It is not often that so happy a combination of science, sound judgment, and ingenuity, come before us, as is displayed in the various contrivances which we shall now proceed to describe in detail.

The figures on our front page represent, 1. a back-elevation of a pair of wheels, axle, and boxes, constructed according to Mr. Hynes's patent, with one of the wheels and boxes shown in section; 2. a side-view of a box, with its external cover on; 3. a similar view of a box, with the external cover off; and, 4. part side-view of a wheel in its complete state.

1. *Of the Locking and Unlocking.*

The axle *a* (fig. 1) differs essentially from all other axles in having shoulders or enlargements, of the peculiar form represented in the engraving, at those parts where it comes into proximity with the inner ends of the naves—the axle and its shoulders being forged or welded together all in one piece. Two holes are *drilled in each shoulder*, through its *entire length*, for the reception of the locking-bolts *e*; and in the back of each nave there are four holes or recipients made at the four cardinal points of a circle, corresponding with that described on the rotation of the axle, by the holes in the shoulders thereof; so that when the wheels are screwed on and adjusted as close as possible to the shoulders, the bolts, on being let loose, must shoot with unerring precision into the first two holes in the nave which they come opposite to. The command of these bolts may be effected, either by a jointed lever, as shown at *gg* in our engravings; one end of the lever being placed within reach of the person riding in the carriage, or of the attendants; or by chains carried to any part of the vehicle which may be thought most expedient, and there secured by hooks, or other holdfasts. The size of the bolts must, of course, depend on the size and weight of the carriage; and also, in some degree, on the uses to which it is to be applied; as, for instance, whether it is to be worked at high or low velocities, whether on a level or a hilly country, &c. The inventor thinks that bolts of from half an inch to one and a half inch in diameter, would be found abundantly strong for the lightest private carriage up to the heaviest stage-coach; and though he considers *two* bolts inserted into the nave, in the manner described, to be quite sufficient to counteract the leverage force of the peripheries of the wheel, he has been careful to point out that the principle of his invention admits of *four* bolts being made use of, equally well with *two*.

As in every case of locking the wheels, a great increase of pressure must necessarily take place at one of the four points on the tires which correspond with the position of the bolts and recipients, Mr. Hynes, to protect the tires at these particular points, defends them with plates of soft steel, or case-hardened iron, about eight inches in length, indented or dovetailed into the tires, screwed thereto, and projecting but little beyond the general surface.

The contrivances which Mr. Hynes makes use of to adjust the wheels to the arms of the axletree, are those commonly known by the name of Collinges; namely, collets, nuts (with right and left-handed screws), linch pins, outer caps, &c. We gather from his specification, that he thinks this the most perfect mode of adjustment which has been yet invented; and perhaps he is right, though on this point it is certain all the carriage-making world are not agreed.

2. *Of the Axletree and Boxes.*

Every reflecting person at all acquainted with carriage economy, is aware that upon *friction* depends draft, and that, accordingly, in proportion as friction is reduced, so draft is diminished, and *vice versâ.* The great desideratum, therefore, is a constant and abundant supply of oil to the arms, and every part of them—oil being the best of all known lubricating substances. The question here consequently presents itself—Have the grooves, or things called "reservoirs," which are now found in all the most improved boxes, ever yielded such a supply? It would not, we imagine, be difficult to demonstrate, that the very best boxes hitherto made never did or could accomplish any thing of the kind. There is an eternal law of nature, that of gravitation, which forbids it. In all of them—take Collinge's for example—there is a small space or groove called a reservoir. This groove is cast in the metal, is situated near its back end, and may contain, when fully served with oil, which can only be to about a fourth of its *circumference*, a table spoonful of oil. Well, at the other extreme *end* of the arm, that is to say, in what is called the "cap" in front of the wheel, there is a similar reservoir, containing, perhaps, another table spoonful of oil. However, *between* this last-mentioned reservoir, and the arm which it is intended to feed with oil, there are two nuts and a coned collet, all closely fitted and screwed on to the axle. Now, be it remembered, that the arm and boxes are presumed to be "*air-tight*," and that the position of the arm is nearly horizontal; and, moreover, that these reservoirs are placed absolutely *under* the lowest point or level of the thing which they are meant to lubricate! We are told, indeed, that the reservoirs *turning* with the wheel, "wash the oil *up*;" and, further, that this constant action of the wheels has the effect of producing a "vermicular motion" about the arm, which, in *its turn, again* causes a "*pumping*" *of the oil all* along the *air-tight* arm, from one extreme reservoir to the other. But does not this amount to a mere reciprocation of impossibilities? The theory might, perhaps, have some little feasibility about it, were the boxes and reservoirs *fixtures*, and the arm a revolving cylinder within them; but as the case happens to be reversed, the arm being a *fixture*, and the boxes *revolving* bodies, no such vermicular motion can occur under any circumstances of time or place. As the box *revolves*, so must the *oil* within it. Beyond the boundaries of its narrow sphere gravitation will not permit it to stir; water could as easily return to its source, as oil mount *up* in the manner supposed, especially when we know that the motion of a wheel near its *axis* is comparatively a *slow* one, even when the *periphery* is in a state of the utmost velocity.

We have, for the sake of impartial comparison, here adverted to the very best boxes extant only, and not touched at all on those which are cast with *serpentine* grooves, which are, in fact, unworthy of comment. They carry in them the elements of their own destruction, for no tools can be made to "clean them out," even if they could be made otherwise effective.

Let us now proceed to describe the improved box of Mr. Hynes. This consists of two wrought-iron concentric cylinders or tubes (figs. 2 and 3), the one about a third less than the other, leaving a space between which serves as a reservoir for the oil. These tubes screw into and upon each other at their extremities, in such a manner that the space between them is perfectly closed at both ends, and the better to prevent any lateral escape of oil, a cap (*h*) is screwed on to both at the outside. But that the oil may pass freely and uniformly to the axle-arm, where it is wanted, the inner cylinder is perforated with holes at equal distances. In every other box hitherto in use, the oil, as we have before pointed out, is supplied to two or three parts only of the axle-arm, and never reaches, except perhaps in very remote portions, the other parts; but as this double box revolves with the wheels, it distributes through the holes in the inner cylinder an equal supply of oil to every part of the axle. As often as a new supply of oil is wanted, it is introduced without taking off the wheels (as the ordinary practice is), or even unscrewing and uncapping the cylinders, by simply withdrawing a small plug in the outer box (not shown in the engravings), which covers a small orifice leading to the intermediate space appropriated to the oil.

Both improvements, it will be observed, are of universal application—to all public as well as to all private vehicles—to railway as well as to common road carriages. The safety-apparatus could hardly, we fear, be depended on at such high velocities, as are becoming common on railways; but to gentlemen's carriages employed for travelling on common roads at ordinary rates of speed, it must prove an invaluable appendage.

◆

KIRKBY SLATE.

Sir,—Having just read in the *Athenæum* extracts from a paper by the Rev. Adam Sedgwick on geology, in which he describes the slate formation, I am induced to send you the following respecting the Kirkby slate in the north of Lancashire, having examined the district in order to ascertain the direction and probable extent of that material, which I have reason to suppose inexhaustible; and also for the purpose of determining the best methods for working quarries, and the uses to which the different parts of the rock appear most applicable.

The district I more particularly examined is about two miles square, in which sections have been made by quarries in many places; in one part, almost in a continued line, for three-fourths of a mile. These quarries, which are open at top, vary in depth from 130 to 250 feet, and they are also of considerable breadth. This, it will be admitted, is a favourable position for observation.

The whole mass of slate-rock there is composed of two textures—the one something finer and darker than the other, but in each separate block perfectly united. These two textures alternate in plates differing in thickness and distance from each other; and this gives to the slate, when the sections cross the different textures, a striped appearance. These alternating textures are, in some directions, to an unknown extent, in planes nearly parallel. The whole of the slate-rock is crossed in various ways, and at different inclinations, by joints or seams; some of these, which are in planes parallel to the stripes, require particular consideration. In some of the joints there is a bed of clay, in others a bed of sandstone, and in others a bed of spar, from a quarter to half an inch thick, like mortar or cement in the joints of stone walls. The distance between these joints vary, some being only a few inches, and others more than twenty yards, sometimes alternately greater and less.

In some of the rock between two of these joints are layers of nodules imbedded in the solid mass, some of which have the stripe and the other texture of the slate, while others when broken are found to consist of a brown, soft substance, resembling rotten stone. These nodules do not intercept or change the direction of the plane of the stripes, and the stripes continue in the same direction and of the same thickness across many seams.

There are also in some places, in beds parallel to the stripes, but perfectly united with the slate material, one appearance called by the workmen a crag-bar, and another a grown-bar.

The several parts in parallel planes thus noticed may be enumerated as follows:—

1st. The stripes.
2d. Texture between the stripes.
3d. Beds of nodules.
4th. Crag-bars.
5th. Grown-bars.
6th. Sandstone joints.
7th. Clay joints.
8th. Sparry joints.

The order in which these several parts alternate with each other has not yet been particularly noticed, neither is this given as a complete series, but they occur in two very different positions. In the one, the several parallel planes are nearly vertical, running from west, where they frequently crop out above the surface of the ground, to the east. The quarries which have this position of the rock are called *back-quarries*. The other position in which these several planes parallel to each other occur, dip to the east or south-east, at angles varying from about 22° to 48°. The quarries in which the latter is the position of the rock are called *foot-quarries*. These two terms will perhaps be better understood, as well as the positions they indicate, if it is supposed that a person standing is looking towards the south. His back will then be in a vertical east and west plane, while the sole of his left foot, with the heel a little elevated, will be in a plane inclined or dipping to the south-east—or, if his toes are turned in that direction, to the east. If the joints of a series of rocks and the planes of the stripes be parallel to the sole of his left foot, they will indicate a foot-quarry; but if parallel to his back, then a back-quarry. The rock between one bed and another being called a *back*, or *foot*, according to its position. The south surface of a back is the south bed, and the north surface the north bed; and the surfaces of a foot are the upper and under beds. The stripes do not appear on the beds of either backs or feet, as they are parallel to them.

The next point to be noticed is the cleavage, or the innumerable planes in which direction the slate-rock may be split, for roofing or other purposes. Although the slate-rock, both in back and foot quarries, appears to have been formed by a series of parallel plates or layers, and there are natural joints, which have been described, in the same direction, it cannot be further split parallel to those stripes or joints; but the planes of cleavage cross the planes of the stripes, dipping considerably to the south, and, in this respect, nearly at the same angle in both the back and foot quarries. But the plane of cleavage in the back-quarries, as far as observation has been made, deviates less from the plane of stripes, &c., than in the foot-quarries. The angle of deviation in the former being sometimes only 18⁰, while in the latter it has been found as much as 70⁰. The back-quarries are further distinguished by being called shear-bate, and by the slates having broader stripes in consequence of the cleavage, across the stripes, being more oblique.

The striped appearance in both the back and foot quarries is, however, supposed to indicate, notwithstanding this difference in the angle of cleavage, that originally they were in the same position. Whether this has been the case or not, I will leave to geologists to determined; only observing, that I have ascertained that to put the plane of cleavage of a foot-quarry into the position of that in a back-quarry, supposing the angle with the stripes, &c. in both to be the same, the eastern end *must be turned* to the *western, and the top, south* part of the foot, turned so as to be the lower part of the north bed of the back. This operation is most satisfactorily shown by a hand specimen of the material. Or, if the specimen be revolved on any line in the dip of the cleavage, as an axis, the change from the position of a foot to that of a back is made in half a revolution, and, by reversing the motion, from the position of a back to a foot. This curious change of position, if it has taken place, is the more remarkable, for back and foot quarries have been found alternating with each other to a great distance, and also the vertical stripes on a back and the inclined stripes on a foot have been observed with only a joint to separate them. If ever a back and foot were in the same position, there are other seams, common to both, which show also that if any change has taken place, it must have been by motions similar to those described.

The planes of cleavage in the crag and grown bars are not in the same position as in the other part of the slate; consequently, when these occur they produce a degree of unevenness on the face of the slate. In splitting large slates the elasticity of the material is very observable. In splitting a slate, say four or five feet long and an inch thick, into two, the opening at one end will be some inches apart before the other is separated.

All slate cleaves, and is more easily worked, when first taken out of the quarry. After being exposed to the air, good slate becomes harder, and it is then more difficult to split. In thus becoming harder, it is supposed it loses some moisture which it contained whilst in the quarry. Whether this is the case or not, it is evident that it has no tendency to absorb any moisture after thus becoming hard; which property, no doubt, is the reason why it remains unchanged in exposed situations for time immemorial.

The price of slate for roofing purposes varies, while the quality of the material of which they are made is the same. Slates which have an even surface, and which are of that thickness which gives them an adequate degree of strength, are considered the best. If slates are large, they must be thicker than smaller ones to be equally strong. But if either smaller or larger slates are thicker or thinner than the average requisite strength for roofing, they are sold at a less price per ton. Slates are reduced in value if they have rough or uneven surfaces. If slates are made to a regular size, the price is more than when they are irregular. These several circumstances should be well understood by architects and builders, in order to apply them to the greatest possible advantage.

If you think this subject will be useful or interesting to your readers, I will at a future opportunity continue it, there being many other points worthy of observation which I have seen in the slate-quarries at Kirkby.

I am, Sir,
Your obedient servant,
JOSEPH JOPLING.

31, Somerset-street, Portman-square.

ON SLATE RAILWAY-PLATFORMS.

Sir,—I have read, with much pleasure and approbation, Mr. Jopling's plan for laying a complete platform of slate, instead of the stone blocks at certain intervals, as a support to the rails of railroads. Many ideas and observations suggest themselves to my mind with reference to this subject; but as Mr. Jopling has so ably taken it up, I will leave it in his superior hands, confining myself to only one point, upon which I may perhaps offer a suggestion, founded on long and frequent experience. If Mr. Jopling will take the trouble to refer to vol. vi. p. 365, of the *Mechanics' Magazine*, he will find some mention of the indurating and concreting effects of animal and vegetable oils, and of coal-tar, applied to aluminous and calcareous earths. Since that paper was written (1826, I think), I have had still further reason to be convinced of the great advantages that might be derived from analogous applications in various departments of the constructing and preserving arts. Mr. Jopling, in his valuable communication, seems doubtful whether copper or brass nuts should not be introduced into the slate for the reception of the bolts which fix the rail. Instead of any such nuts, I will take the liberty of suggesting the following plan:—Let the bolt-holes be tapped with a large thread. During the process let the tap be well soaked and surrounded with drying linseed-oil or coal-tar, instead of common oil. When the female-screw is completed, fill the cavity with linseed-oil or coal-tar, and plug up both ends, so as *to keep in the fluid for* at least twenty-four hours. After the fluid is withdrawn, leave the holes open to the action of the atmosphere as long as may possibly be convenient. Upon bolting down the rails, apply a brush with one of the above fluids to the bolt. I venture to premise that, through the above process, the thread of the slate, and the adjacent parts, will acquire in a very short time a hardness equal to porphyry, especially if the slate be very dry, and be left to the action of the air as long as possible after the first operation. The only question is, whether the process I depict, or the introduction of copper nuts into the inferior surface of the slate, will be the less expensive and inconvenient. Any how, all bolts, screws, nuts, rivets, clamps, &c., should be well paid with coal-tar previously to being fixed in their places. In the same vol. vi., above quoted, there is a paper of mine on the oxidation of iron, which I would make bold to recommend to Mr. Jopling's perusal.

I have the honour to be, Sir,
Your obedient, humble servant,
FRANCIS MACERONI.

Nov. 20, 1835.

THE GREENWICH AND BRIGHTON RAILWAYS.

Sir,—You take blame to yourself (page 7) for suffering my assertion to pass, that Mr. Herapath's papers on Railways were full of "misrepresentations" as well as "misapprehensions." Out of consideration for your editorial character, therefore, I hope you will find room for a few lines, which will suffice to show, that I was by no means to blame for making the charges, nor yourself for giving them insertion.

For what reason, we need not stop to inquire, Mr. Herapath is a red-hot partisan of Mr. Cundy's scheme for a railway to Brighton, and a determined opponent of the rival line of Sir John Rennie. Whether he had any "wish" to "mislead" or no, certain it is, that he indulged in certain assertions regarding this latter line, which, it afterwards appeared, would have most completely "misled" any who had relied on their accuracy. Shortly after they were made, another correspondent, and not an anonymous one either, went some way towards impeaching Mr. Herapath's "veracity," by giving a flat contradic-

tion to nearly every one of his statements. The principal points were five. 1. Instead of 7 miles of travelling out of 47 miles of railway (as Mr. Herapath stated), there is not so much (said Mr. Combe) as 2¼ miles. 2. The longest tunnel, instead of being 2¼ miles in length, is only ¾ of a mile, and there is no such a thing in any one of them as conflicting inclined planes. 3. The steepest inclination, instead of being at the rate of 1 in 97, is only one in 180. 4. The Balcombe Down summit is crossed at more than 100 feet less elevation above the tideway than he (Mr. Herapath) has stated. 5. Instead of having his nervous system endangered by crossing the river Mole by an embankment raised some hundred feet in the air, the height of the embankment required will not exceed 15 feet.

And how did Mr. Herapath repel these very plain charges of "misrepresentation?" Did he bring forward any proofs of his being in the right, and indignantly turn the tables on his presumptuous assailant? No such thing. He did, indeed, make some show of a defence as to the tunnelling, on the vaguest possible authority, backed by the very valuable support of a gentleman with whom he had "conversed," and whom he "*understood*" to have actually "*seen*" the plans! But, on the other four points, the only plea he put in was one so every way extraordinary, so far worse than no plea at all, that I must give it *verbatim*. "It may be asked how I came to depart from my authority, and to call the tunnels only 7 instead of 9½ miles; the *truth* is, except the inclinations, with which I could not meddle, I understated every thing. *I took* 100 *feet from the height of the hills*, another from the embankments, and 2½ miles from the length of the tunnels. In fact, the project altogether appeared so monstrously absurd, that I was afraid to tell the whole, *lest the public should think I was romancing!*"

It may be urged, that this singular paragraph is all a joke; and it does certainly read something like one, that Mr. Herapath, of all men in the world, should so suddenly be taken with a fear of acquiring a reputation for romancing! If it be a joke, it is the only replication *put in to the four very* grave charges against him; and in that case, of course, equivalent to no answer at all, and Mr. Combe's charges are admitted to be true; and, if it be serious, if Mr. Herapath really mean to say that "*the truth is*" quite contrary to what he before asserted, he *convicts himself* at once, out of his own mouth, of misrepresenting the truth.

So much, Mr. Editor, in compliance with the wish of my friend "Anti-H," and in vindication of yourself for inserting the offensive passage. Plenty of other instances might be brought forward; but, perhaps, this will be enough. As to "misapprehensions," they are so plentifully bestrewn through the whole of Mr. Herapath's papers, that it would be a Herculean task indeed to notice them all; but the two or three exposed in my last may be taken for a tolerably satisfactory sample for the present.

To the letter of "Anti-H." I have little to say. He is so "cunning of fence," that it is a perilous thing to enter the lists with him, and his marvellous skill in arithmetic makes him peculiarly formidable. Little did I imagine, when I propounded the rather puzzling question, "Supposing the Brighton Company to pay *the whole of their gross receipts* to other companies for permission to use their lines, from what source would they pay their own expenses, to say nothing of profits?"—little, indeed, did I imagine that it would so soon be clearly proved, that, in such circumstances, the Company would have no less than "forty-seven and a half per cent. per annum" left "for finding locomotive power!" Worthy of each other, most truly, are Mr. Herapath and Anti-H., the two great calculators of the age. If the one seem to "snatch a grace beyond the reach of art," by showing that a locomotive carriage will, of itself, run up hill at the rate of 1,300 miles an hour, the other rivals his giant prototype by determining to a nicety the profits accruing to a concern which pays 100 per cent. on its receipts for a single item of expenditure! Can it be possible for two such luminaries to exist in our hemisphere at once, or may it be that Herapath and Anti-H. are identical? Things no less strange have been. In another point, the pair have a remarkable unanimity in their ideas. Neither of them can conceive the possibility of a railway being constructed on the SURFACE of the GROUND. Yet, strange as it may appear (to them), there are several instances on record of the thing having actually been done! Nay, more, there are some daring engineers who are at considerable pains to keep as much on the SURFACE of the GROUND as possible, even though "swamps, bogs," &c., may lie in the way: indeed, here and there one may be found hardy enough to assert, that it would be easier to make a foundation for a railway alone, through a "swamp, bog," &c., than a support for a tremendously heavy brick viaduct, with a railway on the top of that. As to the remark about crossing the thoroughfares, Anti-H. will find, on referring back, that his worthy principal totally overlooked that feature, and that *I pointed it out in the letter he remarks upon!* There are, however, other ways of crossing thoroughfares than by erecting a viaduct along the whole line; and I flatly deny that any of the thoroughfares the Greenwich Railway crosses are "among the most considerable in Europe." Bermondsey, that is the principal: but many of the remainder are mere countryfied lanes, perfectly contemptible in point of the traffic along them.

I must now plead guilty to the very serious charge of having "misrepresented" Mr. Herapath, when I spoke of his having said, that two of the arches were already "occupied" as private houses. On referring to his letter, I find that he only *insinuated* that they were so, without directly asserting it. "Anti-H." is quite welcome to make as much of this mighty misrepresentation as he pleases,—if it can be considered any misrepresentation at all, after Mr. Herapath's remarks, to all appearance made upon a survey of a couple of *inhabited* houses, as to their being "*comfortable*, roomy, and compact;" and also as to "the inconvenience anticipated from the smoke" being "removed by *the use* of gas-stoves with which the houses *are furnished*." The "charge" altogether is only worth notice as an apt illustration of the adage, "Drowning men will catch at a straw."

I remain, Sir, yours respectfully,

H.

SELECT COMMITTEE OF THE HOUSE OF COMMONS ON ARTS AND MANUFACTURES.

MINUTES OF EVIDENCE.

(Continued from last Number, p. 159.)

Mr. John Henning, examined:

Do you think instruction in the arts generally, in a national point of view, is advisable for persons acquainted with the manufactures of this country?—I think, in the present state of society, as there are so many means for individuals to be instructed, that I do not see that the interference of the Government would do much good. The one great good that an academy or school with a good museum would be, to give facility to study to the willing, who are often prevented from advancing in their pursuits by the difficulty of access to proper models. I would propose a voluntary subscription museum, conducted by a committee of the subscribers, in places where these were to be found, furnished with models of every description, particularly all mechanism of every department of manufactures, every kind of fabric of cloth, plain and ornamented, or coloured, and if possible the mechanism by which it has been done. A museum of this kind, with proper regulations, under the care of a person or persons qualified to make it useful, under the control of a committee, would be of much use in promoting skill in art and science in design, whether it were the highest branch of art or the more common, where the artisan plans to combine beautiful forms with various colours in fabrics of cloth; in short, in every profession it would be of use that the operator should be able to draw any thing which may occur in his profession; the surgeon, by drawing and modelling, would acquire a more correct notion of the position of the localities of the veins, arteries, &c., of the human body, and so with every art. Drawing and modelling give great power of description. I think society ought not to trouble the Government with things which it can so easily do itself; and done in this way, I think that it would have the best effect; while it would be a proper stimulus for the improvement of talent, it might bring to light the more rare and superior minds, and lead to the existence of a general true taste in the decorative arts. The carpenter would study what related to architecture; the geometrical construction of roofs, centers for bridge-building, &c.: the cabinet-maker would be engaged also in straight-line drawing, construction and the ornamental parts of his art.

The question referred to art rather than manufacture?—Every man who follows any profession should have something of drawing relating to his profession; and a workman, such as a jeweller, ought to be a draftsman, for he in fact does not work by the square and the compass, but by the eye; therefore he should be taught drawing.

You think the principles of drawing should be united in some way with elementary education?—Yes, with every profession, and the weaver as much as any; most of the weavers of my native place, Paisley, used to draw their own patterns, and many of them could do their own machinery. The drawings in many cases done by themselves were transferred to the cloth by what they called "reading it on the holly brod," which seems to me to correspond with the *mise en carte* of the French. At that time (forty years ago) many could mount their own webs; now from the division of labour this has become a separate business.

How did you obtain the original casts from the Elgin marble, from which you made these smaller casts?—When I arrived in London in 1811, through the introduction of Mr. Murray, brother of the Lord Advocate, I was introduced to Lord Elgin, who gave me permission to draw from the marbles. He told me it was requisite for a member of the Academy to give a recommendation. His Lordship entered my lodgings one morning with a gentleman of the Academy, who after examining some of my drawings, medallions, busts, &c. spoke in very complimentary language of them. Lord Elgin said that I was desirous of being allowed to draw from the marbles; the gentleman answered in great earnestness, "To allow Mr. Henning to draw from the marbles would be like sending a boy to the university before he had learned his letters;" a few minutes after, they left me a little surprised. However, within a quarter of an hour his Lordship returned, and told me that I might begin to draw whenever I thought proper. Such was the origin of my studies from the Greek marbles. They were not in the British Museum then, but in a temporary building at Burlington House, Piccadilly. He gave me permission to draw, with this proviso, that I was not to make any publication without his permission, which I very willingly assented to. They were afterwards moved to the Museum, and I got permission of the Museum to continue my drawings there.

From whom?—The officer of the Museum, Sir Henry Ellis; he was then Mr. Ellis.

Did you at that time take any moulds?—No; for I still felt that with regard to Lord Elgin, I had no liberty to make any publication without his permission. Then, on their being introduced at the Museum, I asked my friend, Mr. Horner, who was then living, if he thought the Museum would allow me to publish them. He said he thought there would be no difficulty. I wrote to Sir Henry Ellis, who said there would be no trouble from the Museum. I proceeded with my drawing, and afterwards several gentlemen asked me to make small pieces in ivory; and that is a cast of one I have brought.—[*The witness refers to a specimen on the table in white enamel glass.*]—I found in working on a round surface the sculpture in ivory, that every time I touched it the tool left a mark, and then I tried to make it smooth, I found, on account of its smallness, it was like labour in vain. I then thought that I could produce a better work by intaglio engraving; for by working hollow I found that I could introduce the veins and other minute work in intaglio, which must have taken immense labour upon the ivory.

From whom did you receive encouragement to proceed with this work?—I was doing some modelling for the Duke of Devonshire, and the late Princess Charlotte, Marquis of Lansdowne, Earl Rosslyn, &c.; they had seen my drawings, and some expressed a wish to have some pieces of the frieze of the Parthenon in ivory, from seeing my drawings, which were done eight inches high, being one-fifth linear measure of the originals; the intaglios are one-twentieth of the originals.

How did they become cast and sold cheaply to the public in this shape?—I cut them under this impression, that I could do them better on the slate. I first published the frieze of the west end of the temple, the entire composition of which is horses and cavaliers, some dismounted.

In casts?—In the sculptures of the west frieze we have but one piece of marble, No. 47; it is the first piece from the salient angle of the north-west corner; it was taken out of its case in my presence, and although I protested against it in very good humour, it was laid upon the ground under a window which admitted a considerable quantity of water upon it, for two winters; it now exhibits marks of the ravages of our climate on marble.

Of this size?—Yes, my reductions are the twentieth part of the size of the original.

Who were the principal buyers of the casts?—The Duke of Devonshire, the Marquis of Lansdowne, the Duke of York, and George IV., with other nobles, gentlemen and ladies.

Have you found the sale for them extend through other classes of society?—No, not general.

Do you consider that you would have had a great number more purchasers for those articles if the law had protected you as fully as it ought to do in your original design?—I have no doubt at all about that.

Do you believe the public demand for those articles is almost unlimited, if the people had free scope for them, by giving the artisans the opportunity of seeing beautiful specimens of art, and protecting the artist when, by his original invention, he has discovered any way of promulgating it?—No doubt of it; I made no secret of it, I would not find fault if he copied; but it is another thing to take my labour.

Your labour in this instance consisted in filling up the defects which had been created in the frieze of the Parthenon, and re-forming them on that scale?—Yes.

And this, like many other inventions, has been pirated, and you have not been protected from the expense of bringing an action at law, which the statute gives you, and also from the want of a tribunal of ready access?—That is precisely the case.

Have you had experience in taking casts from larger statues in wax?—They could be taken of any size; but I have not had experience in larger ones.

As to the comparative expense of wax and plaster, considering the injury that may be done to the marble by taking frequent casts in plaster, have you any thing to state?—I apprehend that plaster is more proper than wax for that purpose.

Have you never known the surface of the marble injured?—That must be by a person who has no knowledge of the thing, if they injured it.

Have you heard complaints of artists, that the fine mellow colour which is given to the marble, was liable to be injured by taking casts in plaster?—No, it will be cleaner; the plaster is a very cleansing thing, it takes off every kind of dust, and a good deal of dirtiness it will remove.

Would not the taking casts in plaster frequently tend to slightly alter the colour of the marble?—I dare say it might, but if done by one who really understood what he was doing, I would not fear any danger.

Would that be the case if casts were taken in wax?—I apprehend that it would be impossible to take a good cast in wax from marble.

Would it be impossible to take a good one from the smaller bronzes, for instance?—If it is a mould in separate pieces, it is almost impossible you can make portions of a mould in wax; but to make a mould of an entire head or figure, I think it is impossible to make a good thing of it in wax.

Do you apply that remark to small works of art?—Small or large; if you use the wax for taking a mould from the round, it is generally done by pressure (unless it be bas relief); with wax you could not make it good.

But considering always the great importance of giving the most extensive circulation to the finer works of art, do you not think it *desirable that some experiment should be made, as to the possibility of* taking casts in wax, with a view to the prevention of injury to the marble?—Certainly.

And that the circulation of works of art of the first class would tend generally to improve the taste of the people?—I have no doubt of that.

You would think it advisable to engage every means by casts of giving every facility to try different materials (provided they did not injure the statue), in order to circulate the knowledge of the beauty of the original?—Certainly; but I apprehend we have nothing to compare with the plaster of Paris. I would just say as to arts in general, that it would be well if we were to adopt the plan I did with the Athenæum and the façade of Hyde Park Corner, I mean cutting it on the stone at once. We generally take a model and draw out by points that which is cut in stone. Now this shows the great advantage and the propriety of having the drawings in the first instance; every practical man, if he is inclined himself, should not only be able to draw things connected with his art, but if he cannot make his tools he ought to be able to direct them to be made.

Supposing the labouring stone-mason were instructed in the principles of drawing, one might suppose it would tend to encourage original works of art, and produce much more accurate copies of the finer ancient works of art?—No doubt; it would not at all injure those who choose to make gods and angels, or make their works for the drawing-rooms or cabinets. There are a certain sort of minds that follow their own track; if I had had the opportunity of a school, or rather museum, I would not have been an artist, but a mechanist or engineer; my pursuit in early life was geometry and mathematics, and their application to architecture, carpentry, mensuration, navigation, &c.

In your own case, have you had reason to regret the non-existence of such a school?—Yes.

What means were adopted to preserve the frieze of the Athenæum and Hyde Park Corner, from injury from the atmosphere of London?—It was waxed; I adopted it from a circumstance I met with ten, or fifteen, or sixteen years ago; on my arrival in London, wherever I went, I was careful to examine the condition of stone buildings, the state of the wall of Somerset House towards the river attracted my attention; I saw something projecting from the stone, which on examining I found to be a shell, and I could not help reflecting that this could not have grown out of the stone, but the wasting of the stone must have exposed it, as the projections of the shell was at least half an inch. I concluded that Portland must be very liable to destruction, from the moisture to which it was exposed in this place; from this I was induced to notice in some places, where the builder had not been careful to lay the stone according to what is called its bed, that it sometimes split with the lamina, and fell off in large portions when the lamina stood perpendicular. When I first went to see the façade of Hyde Park, I was surprised to find the cornice in some parts in a state of decay, although not three months from the chisel. I noticed something like crystals of common salt at a place where the stone seemed in rapid decay. I tasted the crystals alluded to, and they appeared to me the taste of common salt; thinking upon this, I thought it no longer any wonder that Portland stone should be so soon in a perishable state; on this account I suggested doing it with wax. It was also my intention to have suggested the propriety of doing the top of the gate with the wax, except where it was covered with metal, which I imagined might prevent the moisture from getting into the stone, and thus have a tendency to secure the durability of the building; but the fear that such an advice might have been reckoned fishing for a job, I had not hardihood to propose it. It will soon be seven years since the façade of Hyde Park and the Athenæum friezes have been finished; it would be curious to inspect them to find which has best succeeded, or if either in preserving the stone.—(*See* No. 638, p. 94.)

George Rennie, Esq., examined:

I have resided a long time abroad; nearly eight years in Italy and different parts of the Continent. The result of my observation in the different descriptions of manufacture in demand in Italy is, that the cheaper and plainer description of manufactures are most of them English, such as plain calicoes, the commoner description of printed cottons, cutlery, and earthenware; but I have found the shawls, figured silks, printed muslins, porcelain, and, in fact, every description of fancy goods, either French or German; though the conviction on the minds of the Italians is of superior durability and solidity in the material of the English article; I may say I have no doubt that if the English manufactures were equal in design to the French, they would be preferred. English manufactures have improved since the French were more freely introduced. I should say by imitation rather than by any invention. The reason why the French excel us in that description of goods where a knowledge of art and design is necessary is, from the facilities afforded in France for educating artists to design for manufactures; I am not aware that such means of instruction exist in this country for artists who apply themselves to manufactures as in France. I consider some branches of the arts necessarily *require instruction, particularly anatomy and perspective.* I consider it also highly desirable that every other branch of art should be taught, particularly botanical drawing. Though as to schools, I think it requires great consideration how far the Government ought to assist, because though at present it appears from the state of the knowledge of design generally throughout England, that there is an absolute necessity for some encouragement; at the same time great caution is required that too much should not be done. The effect of what I allude to would be to establish a sort of central or general mannerism by too much legislative interference. I would limit instruction to that which may be said to be positive, exact, and true in art, without allowing it to overstep those bounds. I think it very desirable that some central establishment should be formed, by which I may say a central impulse might be given, without the branches being too much affected by that central influence, so as to reduce the whole to the same manner. I should say it would be very desirable that there should be a central museum in London, and in the provincial towns that there should be branch museums, where every species of casts and models, or means by which design might be promoted, should be transmitted from London to the provinces, and *vice versâ*. Unless there were a central system, probably one museum might become possessed of something it was desirable every museum should have; but without some general organization this could not be effected. What I allude to is casts from statues, original ornaments, &c. that could be cast, in plaster, and transmitted from the central museum to all the provincial museums. The people have better means of instruction by open galleries abroad than in England; in fact, in London there is not a collection of casts accessible to an artist at all; though in the British Museum there are a number of very fine marbles, there is no collection of casts from the finest statues throughout Europe to which an artist can have access. The Royal Academy have a few, but the room is so small and badly lighted, that except to their own students, it is generally inaccessible; there is no collection of casts from which an artist could improve himself, and which it is desirable and necessary to have. I have felt in my own profession very much the want of such means, whereas on the Continent such collections exist in every town of any consequence. I have not observed the Mechanics' Institutions; but I am justified in saying thus far, that there is no Institution in England to any extent for the application of the arts to manufactures; in Edinburgh a Society has existed for many years. Castings of works of art in iron might be made more extensive and useful than it is; statues or works of any kind in cast-iron might be advantageously employed for adorning public walks and public buildings. I think an exhibition or collection of the best specimens of manufacture from every part of the world would be highly desirable in this country. The mode of registration by which protection could be most practicable to the copyright of designs, I conceive might be had this way:—if there were a central board in London, where a manufacturer, on producing a design, could deposit a copy and register it, that there should be branch boards at Manchester, Birmingham, and all the principal manufacturing towns; and when the invention was pirated, the manufacturer should apply to the central or provincial board, who should summon the parties pirating the invention before them; and it would be desirable that the board should have a magisterial power to receive evidence on it, and convict summarily. I think the tardiness and expense of the law is one of the great causes of the want of protection at present. It would not be necessary for an inventor in London to deposit his patterns in every provincial town; for if a case arose in which an invention originating in London was pirated in Manchester, on the information of that being given, they might send the original pattern, or copy of it, to Manchester, and the offender might be convicted there; or *vice versâ*, if the Manchester invention is pirated in London, by having a central board, the pirate of the invention could be convicted here. The inventor might deposit one specimen of his work in the local registry or with the local tribunal, and the other with the central; supposing the invention at Manchester or Birmingham, it would be rather expensive and unnecessary to deposit copies at every board. In fact, in some cases of models, it would be so expensive as to preclude it, nor do I conceive it necessary. I conceive that London being the great mart of every production, an inventor in the country should register at the central as well as at his provincial board, to give him more efficient protection, and I think it highly desirable that the board should have magisterial power to convict summarily; and the local board should have the same power. I think the standard of public taste would thus very soon be raised, by opening a museum in every town. It is allowed that the public taste has improved greatly as regards manufactures, since the French patterns have been introduced. We may expect in the same way if museums were opened generally, the public taste would be improved, and it would give the artists the opportunity of instructing themselves; an exhibition will always stimulate invention. When I alluded to non-interference of Government, I think the danger of *establishing schools is* not that there is *danger of giving assistance*, but it is in establishing every school on exactly the same system, so as to destroy the individual character of the separate school, although I think it quite necessary there should be a central system to give encouragement without absolute control.

James Crabb, examined :

I am chiefly engaged in the designing and the execution of fancy works, particularly with regard to the arrangement and decoration of rooms. The French papers are superior in design, both in the original idea and in the detail of the drawing; they appear to understand their subject very much better than we do in England. In England we have no schools to obtain such instruction; the foliage of this [*producing a French paper, landscape and figures*] is very beautiful; the superior style in which the whole is executed, shows that the designer must have carefully studied the aerial perspective of the colouring, as well as the general form and design; the spirit and truth of the animals surpass any thing we should accomplish for a similar purpose in England. I do not find the journeymen are sufficiently instructed to produce works such as the journeymen of France produce. In the instance of the French paper produced, the printing of it requires a certain degree of taste and knowledge in the actual application of the colours: and if we had the same blocks, I do not expect there would at present be found in the English journeymen sufficient intelligence to print or produce the whole design equal to the French specimen. I apprehend that the workmen in France must have a certain degree of instruction given them with respect to the mixing and most judicious mode of applying their tints. In the designs for a French landscape paper, the aerial perspective is usually beautifully attended to in the printing, as well as correctness in the botanical features; and unless the journeyman had the subject familiar in his mind, he could not execute the work with the freedom with which it is evidently done; for instance, I expect that this colour, which here represents a cloud of dust, is put on in a body with a brush, and then softened and made to assume its present form with a sponge; this is the journeyman's own act, and he must have been instructed how to convey the idea, or he could not do it, especially in the distant foliage, where the same plan is pursued with beautiful effect. This is printed by the common process of printing, by wooden blocks. Our block-cutters are not inferior to those in France; but I may say, that, if we had the very same blocks with which this set of paper is printed in France, we in England should not get so good and well-executed a paper, because in the paper printing also a certain portion of time is occupied by elementary education in

France, which our workpeople do not receive. There is no superior or foreman in a manufactory who could possibly attend to all these little things, which nevertheless give the work the superiority it possesses; they must be done by the intelligent journeyman, assisted by the artist's general superintendence. In England, the landscape painter must be employed to supply such a design as this, and his time would be too costly to be employed in superintending the execution of it; we want a lower rank of ability, one that the manufacturer can afford to employ throughout his work. As regards English papers for ordinary rooms, there is a great variety of beautiful patterns published. English taste for superior designs in paper has much advanced lately. There are finer patterns produced than formerly, especially flock papers; but we have yet as many inferior designs as good ones. I think the taste which has prevailed for some time, of colouring the walls of principal rooms a plain colour, is declining; the style of Louis XIV., and others of a rich character, are being adopted. In the carving of the designs for picture-frames and glasses, the same deficiency is found among the English workmen that I have spoken of among the workmen connected with paper. We find the greatest inaccuracy in the carving of fruit or flowers; we find them very bad indeed occasionally. I attained my own skill in designs principally by my own exertions; I have never had any sort of information given me; my father is a designer, and, of course, I have always been accustomed to see it, but I have never had any sort of introduction to works of art. I have derived no benefits from any public instruction given in this country. The only galleries are the British Museum and the National Gallery; I have found great assistance, in respect of colour, from the paintings in the National Gallery. I consider that the more extensive our acquaintance is with works of superior art, the more original and correct our conceptions would be. The ordinary education of a person intended for our profession would be apprenticeship to one who carries on the business of a designer, or decorative painter (a separate business). A youth is apprenticed, and immediately is put on such work as it is found he can do inferior portions of, the patterns of his master; and he continues doing what he is able progressively; if he has ability or inclination to pursue the study of drawing in any way during his leisure hours he does it, but seldom receives encouragement and assistance to do so at any other time. The same course is pursued through the whole apprenticeship. There is no knowledge of the antique given; any classical allusion that he makes in his designs is quite chance. Supposing a series of decorations were wanted upon a particular subject, for instance, the history of Cupid and Psyche, if I were not possessed of more than an ordinary degree of information in my profession I could not do it. I should inquire of English artists by profession their charge for designing such a subject, and of the printer the cost; but I apprehend that the cheaper way would be to go to France, where, without difficulty, I could obtain both the design and the paper made to my order. [*The witness exhibited a drawing of his own to the Committee.*] The drawing is taken from the Elgin Marbles; I drew that and others from an engraved outline, and corrected it by occasionally visiting the Museum, and on my return, corrected my drawings. There is no engraved outline of this size; it is twenty inches high. I enlarged from one about four inches by six. The demand for patterns or specimens of the antique taken from Pompeii, or from the classical models, would increase if there were opportunities for satisfying it; but the expense is, at present, too considerable for general patronage. One means of increasing it might be the diffusion of elementary education in arts and designs, so that you might employ men at a cheaper rate, capable of executing works of this description. For instance, in that pattern [*alluding to the drawing of the Elgin Marbles*], having had no instruction as to the general proportions of the horse and the figures, the difficulty, supposing I had a quantity to execute, would be very considerable, because I must make drawings of the whole to a scale first; now, if I were more conversant with the proportions, I could execute it without, and, in that case, I could make quite as much money, and the work would be done cheaper, by being done with facility. I propose to apply paper of this pattern below the frieze in a dining-room, or on staircases, in sunk panels, so as to produce the effect of a bas relief; and if paper of such a pattern be executed cheaply, that is, if our journeymen workmen could assist in executing such patterns, there would be a great demand for them, and they certainly would be then extensively employed, either painted or printed; we should have an opportunity of employing them now, but for the expense of executing. The pattern-drawers for calico printing furnish us with many patterns. We borrow from each other. We copy their ideas, although the actual design may not be copied. Schools or institutions liberally established for the purpose of instructing persons like myself, in the correct principles of design, and in extending their knowledge of the arts, would be very beneficial to them. [*Two more specimens were exhibited.*] Of these specimens, one is French and the other English. I apprehend the mode of printing the English one has been copied from the French one, from the mode in which the French one is done. I apprehend these specimens of French paper were imported for the purpose of assisting the printing of English paper, not for this pattern alone, but various others which have been introduced by the same house in the same style as this French one. The best qualities of the French paper are the superiority of the drawing, the elegance of the lines, and the variety which is given to the colour, and it is more true to nature; in fact, there is a better knowledge of botany in it than in the English one: there is in the English one no knowledge of botany shown; in the French there is decidedly. [*Some more specimens were exhibited to the Committee.*] These are all French flower borders, which are very well executed; they are most beautifully drawn. [*Exhibiting another.*] In this English pattern, the leaves are not those of the flower, which is an inaccuracy that we never find in the French; they use the leaves of each respective plant with the finest possible effect. The effect, contrast, and combination of the colours, as well as form, are superior in the French; this facility of adapting the forms and colours most gratifying to the eye, must be the result of early and continued acquaintance with flowers and plants. I am not aware of any information that can be given with respect to the harmonious arrangement of colours; for instance, here is a drawing, and there are others amongst those in which the colouring is entirely my own idea, but it is done without rule. In France they would do it on a fixed principle. I am not aware of that rule, except just in a superficial way. The French colours are also themselves more brilliant than any printed English ones I have yet seen. There is no want of talent among those who, like myself, pursue this branch of trade. It only wants free scope given to it, and proper instruction. Men want opportunities in early life to make themselves generally acquainted with the various proportions of the human form, animals, architecture, and, especially, botany, and the principle of combining colours to form pleasing effects, and a knowledge of the principle of colouring; we have no certain principle to go upon; all these advantages may be obtained in England at present, but at a great cost; they are not attainable by those whom it is necessary should have them. There are works of art, engravings, and works of great merit, which *will never come under* our observation, al*though we know* they are in existence, and would be of invaluable assistance; they are in the libraries of architects and men of superior fortune and talent, and we have no access to them, which, if we did have by means of a public institution, the general taste would be wonderfully improved and extended; it furnishes able men to direct the student, and is a repository for fine examples of art. An intelligent manufacturer, I apprehend, at the head of a business of this kind, would give to his foreman and principal workman, opportunities of obtaining that extended knowledge which might be obtained in England through a public institution; he would make a point of doing so for his own advantage. Now a botanical garden would be of the highest value; for there is scarcely any thing where, in some form, botany is not introduced, and the more extensively you are acquainted with it the better; you get more beautiful lines, more original effects and finer forms than you do by any other means; and the same with foreign birds; occasionally you have fine birds and colouring to introduce, and where you have an opportunity of studying them at your leisure from nature you can, when required, introduce them and other objects with facility. We find no colouring equal to that of nature; the illuminated missals are also applicable to our business. Now, with regard to the British Museum, supposing I could have access in the summer from six to eight, in order to design from any of the statues of marble or friezes there, that would be a great advantage. I have turned my attention to the embossing or ornamenting of leather in lieu of paper for rooms, but without success; it is not followed or understood in this country at present to the extent that it was, not for rooms; it is merely for the backs of superior books, and various things of that kind, but to no extent. It used to be made principally in Holland. The taste for superior decoration is increasing; in noble rooms it is the style and whole effect that marks our taste, not merely the paper. The consumption of paper-hangings was always very large, but I think the taste wants more general improvement with regard to the adaptation of the patterns, the arrangement of the paper, and its embellishments, a particular always attended to by the French, than in the execution of our ordinary bed and sitting room papers. There is not sufficient knowledge among the master paper-hangers as well as the inferior workmen, the persons who direct the work; there is not that taste there should and might be, by more widely diffusing a knowledge of the beautiful effects to be produced by combination of colour. A gallery for exhibiting works of original design would be an advantage.

James Skene, Esq., Secretary to the Board of Trustees for the Encouragement of Manufactures in Scotland; also Secretary to the Royal Institution for the Encouragement of the Fine Arts in Scotland, examined:

My opportunities of acquiring information with regard to the advantage which manufacturers may derive from an increased knowledge of the arts of design, have been during the greater period of my life; I was educated abroad, and stayed in one of the foreign academies of design for three years, when a young man, and since that period I have been about ten years in different countries, and being fond of art myself, I have paid considerable attention to that subject. The Board of Trustees was instituted at the time of the Union of England and Scotland; in consequence of some alteration that took place in the customs and duties connected with the two countries, a sum of money became due by England to Scotland, payable to different establishments and different individuals. The surplus of that sum was appointed by Government by the 15th article of the Treaty of Union to be employed in all time coming for the encouragement of manufactures in Scotland. That was the first establishment of the Board of Trustees in the year 1807; at that time an annuity of 2,000*l*. was appointed to be paid for seven years to the board. That was the first grant. The board, nevertheless, was not established till the year 1727; there came to be accordingly arrears of that 2,000*l*. for seven years, which made 14,000*l*., which was then paid to the board, as also a sum of 6,000*l*. of farther arrears after the annuity had been made permanent, and laid the foundation of their funded property. The grant of the 2,000*l*. was then rendered perpetual, and they have ever since received that sum. Various alterations have taken place in their proceedings, and their funds have been considerably augmented; some of their funds being in the public securities during the war, and exceedingly well managed, considerable savings were obtained by that means; so that now their funds consist, in the first place, of the annuity of 2,000*l*. payable by Government; they have the sum of 30,000*l*. at present in the hands of the Water Company of Edinburgh, for which they receive the interest; they have 15,000*l*. in the hands of Mr. Innis, of Lochalsh, also yielding interest; they have a sum of 1,000*l*. in the hands of the town of Edinburgh, which at present yields no interest, as the town is bankrupt. They built the Royal Institution, a large building in Edinburgh, for the purpose of accommodating different learned bodies there; the Royal Society, the Royal Institution for the Encouragement of Arts, and the Institution for Antiquities (the Antiquarian Society as they call it), and also for the accommodation of the Board itself; they receive rents from those other societies which amount to the annual rent of 740*l*.: that constitutes the fund. The principal means which the board have followed for extending the knowledge of the arts among the people of Scotland, has now been in operation for about seventy years; about seventy years ago they established a school for drawing, being aware of the advantage which foreigners possessed over this country as teachers of design at that period, they got a person of the name De La Croix, a Frenchman of considerable skill, who set that institution a going; it was for the accommodation of forty pupils taught by one master, and the pupils are admitted gratis. They offer specimens of their capacity, and certificates as to character to the Board of Trustees, and they judge of those who are to be admitted, giving the preference to those who seem the most deserving of it. It is an establishment which very soon rose into great repute in the country, and has continued exceedingly successful ever since. The number of pupils has remained stationary, with only one master. It has been managed since the period of its first establishment by a series of very eminent teachers. The person who now holds it, Mr. William Allen, is the first artist in Scotland. The Board contemplates extending it, and they are at present taking measures for that purpose. Hitherto it remains on the same footing, only forty pupils, but so great is the demand of the public for the extension of it, and so high does it stand in their estimation, that although there are about four or five elections of pupils in the course of the year, there generally are at least ten candidates for every single vacancy that occurs, and it comes to be a matter of very disagreeable administration to the Board to reject so many young men from having instruction in the art of design, when they seem desirous to obtain it. The pupils are principally engravers and statuaries, also artists, coach-painters, house-painters, and manufacturers; persons of that kind. Mr. Wilkie was educated there, Mr. Barnet, Mr. Wilson, Mr. Allen himself. I believe there is not an eminent name in the history of art connected with Scotland where the individual has not been educated at that academy. It has produced the most eminent men, either as artists, engravers, or as connected with any of the corresponding professions; in fact, it has done a world of good to the country. The candidates produce specimens of their talents for drawing; they produce certificates of their good character; the Board is very particular upon that subject: also if they are apprentices they produce certificates from their masters that they will give them the means of attending, and then all these are examined by the Board of Trustees; and that young man whose name perhaps they are ignorant of, but that young man whose qualifications seem best, is the person elected. The only preference they seem disposed to give is to the younger classes of them in preference to older ones. The Board of Trustees also established a branch school for the express purpose of teaching the pattern drawing for table-cloths, diaper, and matters of that description, at the town of Dumfermline; it was upon a particular system, and the Board engaged to give 50*l.* a year to a master, provided the manufacturers of Dumfermline would contribute an equal sum. They did so, and that school was in operation for a good many years; I do not exactly recollect the number of years, but for a good many years, and was exceedingly beneficial, and, in fact, was one of the great causes, in conjunction with the encouragement of premiums for the best articles of manufacture given annually by the Board, of raising the establishment of linen manufactures in the town of Dumfermline. Last year the manufacturers declined contributing any further to it, because it had been reduced to a few only, who contributed their proportion, and these few, two or three of the manufacturers, said the burthen was too hard upon them, and they could not contribute any longer, wishing the Board to advance the whole sum of 100*l.* That was incompatible with the idea the Board had of ensuring the establishment which they fostered, being one beneficial to the manufacturers themselves, that they themselves should give the whole sum, and therefore they declined giving it, and that school has accordingly fallen. They found it advantageous, but the whole body of them were disinclined to contribute to it. There were two or three who continued to contribute to the last, but they found 50*l.* a year was more than they were disposed to give. The master could not undertake it under 100*l.*, and the Board was not inclined to give above 50*l.*, which they originally proposed. The designs of French shawls are almost confined to the Indian patterns; but I believe it is the general opinion, that the French have exceeded even in that respect the English in their patterns, because they have turned their attention to it in a more efficient manner. There is a school at this moment in Paris, where about seventy pupils are instructed expressly in that particular branch of shawl patterns, taught by a person who has written a pamphlet on the subject; and I believe the price of their shawls is under that of this country. I am not aware whether the Mechanics' Institution *there give any instructions* of the kind; but *the Board of Trustees* being aware of the deficiency in that respect, has now sent an exceeding clever artist to Paris, for the purpose of gaining information upon that subject, whom they mean to introduce to the Academy at Edinburgh, and to establish a class for that especial purpose, not for teaching shawl patterns alone, but patterns in general connected with manufactures. It appears to me that the best footing to establish those would be to have a system of instruction; a centrical establishment upon a regular system, which should not be deviated from in any respect; I have not any doubt that in a very short time a number of students would be raised in that centrical establishment, who might then be sent to the different parts of the country where they might be required, and establish branches in communication with the centrical establishment, and under the same regulations and the same superintendence. That at the same time would serve not only as a school for instruction, but also a kind of *haut ton* for the most recent improvements in all the different combinations of art connected with manufacture. I should be disposed to extend it pretty far in that respect, particularly to make it an establishment of different classes. One of the great defects in the mode of instruction in this country is, that the first branch of art, namely the fundamental one, is that which in this country is neglected; that is, what is called drawing from the round; it is, in fact, the rudiments of design, the most indispensable, although the most neglected; except the Royal Academy and that academy of the Board of Trustees, I am not aware any other teacher of drawing does really adhere to that system, which I know in French academies to be the only system that is taught, because they conceive; and it has been the opinion, I believe, of artists for many generations, as well as the old masters, that this is the only species of study which is requisite to form an artist. If he has once acquired a knowledge of drawing from the round, or drawing from objects of beautiful outline, and containing means of light and shade, that he is enabled then to turn his talent to any of the branches that he may require without any further instruction. In this country we seem to take a secondary part of it; to take instruction in a more advanced part, and neglect the rudimental part. In correctness of drawing the human figure, and in the knowledge of proportions, we are very deficient; and on that account I would make it a rule of that establishment, that the first class should be that one in which instruction is given in chalk drawing on a large scale from the round, having a series of second classes where the different branches connected with the useful arts were taught, which covers very many; architecture and all other branches connected with the useful arts, ornamenting, decorative, house-painters, and so on. I would not only make the fundamental principle (correctness of design) the object, but also what may be termed the perspective in botany, and those things which are connected with certain sciences which may be called positive parts of art. It appears to me, a very little instruction, perhaps a few lectures, on this, as far as it is applicable to the useful arts, would be sufficient, that is, on anatomy, chemistry, optics, with reference to colours, and botany. It appears to me there is a very great defect in general in our patterns, in botanical accuracy, where flowers are introduced; the foreign pattern-drawers are uniformly correct; our pattern-drawers very seldom so. I would have a third class for the higher branches, and for the purpose of artists; but that confined alone to men whose object in life was to be artists. I would have a certain subdivision of instruction, so that pupils coming there, and wishing to devote themselves to the study of casting in bronze or in iron, or studying modelling silver, or turning themselves towards pattern-drawing on cotton or on silk fabrics, might have the means, after a certain time, of turning their undivided attention to any particular branch of that kind, comprehending the requisite acquaintance with the manufacture itself; so that they might go out from the institution, having chosen that division of the subject most suited to their capabilities; they might go out as manufacturing artists, to accomplish the particular object which they felt themselves most particularly qualified for. And the purpose I should have in dividing it into classes, would be this, to, in fact, repress an error which those academies are exceedingly liable to fall into; and which the academy of the Board of Trustees in Scotland has already fallen into; that is, of neglecting those parts of the study which apply to the useful arts, and dedicating their attention alone to the higher branches; in fact, making all the pupils study as artists, and not as men to pursue useful branches of occupation. It is an exceedingly dangerous thing to pursue, in such institutions, those portions of art which may be said to be connected with individual taste or individual genius, since the tendency of so pursuing them must be to neglect those portions of art which are positive and true, and founded upon unvarying principles of art. I consider that the division into classes might prevent this tendency; because, if the first class is imperative that no pupil could enter the academy without going through a course of that first class, then he would be enabled to turn his talent to any branch of design he might choose; he may then quit the academy. If he chooses to follow out the pursuit to the highest branches by the recommendation of the master, he may be permitted to do so; but it has been experienced in those academies in Scotland, that many pupils who come there with a view towards the useful arts have quitted it and become artists themselves. At the academy in Edinburgh, where forty pupils are taught, the master receives 150*l.* a-year, and there is an officer receiving 50*l.* a-year; and with taxes and lighting and fire, and so on, there are some other expenses, but of no great importance, and that is the whole amount of it; and supposing subordinate schools were established at Glasgow, Paisley, Kilmarnock, and other manufacturing towns in Scotland, I should conceive that a sufficient master would be found at 100*l.* a-year to carry on the establishment. It would not do for a master, at certain times, to make circuits through the manufacturing districts, and give instructions for three months, or some such period. Drawing requires a little time; and although it does not require very great labour on the part of the master, it still requires a certain degree of superintendence, that he sees what the pupils are doing; but it appears to me, the more numerous an academy is, the more advantage the pupil derives from it, because he improves by what he sees his neighbours doing; it does not require much labour on the part of the master, but it requires a person to be able to correct where errors occur. In that school of forty pupils I have not any doubt, that, at any period, six or eight might be drawn from it perfectly capable of teaching the art of design. On the supposition that these establishments were formed and connected so with the mother establishment in Edinburgh, publicity should be an essential ingredient of all their proceedings, and the state of the school, the number of pupils, and accounts of the funds, should be annually laid before Parliament. It would interest the public on the subject, and the interest of the public is very much wanted. Reports of our academy are made to the King, that is to say, to the Treasury. They are not made to Parliament at present, but they might easily be extended to Parliament. The Board established prizes for pattern-drawing in their academy, and a good many very creditable specimens have been, within two or three years, produced; but there is one deficiency there, which shows the necessity of teaching for that matter, which is this; that many of those patterns that were exceedingly beautiful, were not altogether adapted to the operative part of the manufacture; the persons were not conversant with looms, not conversant with manufactures in fact, and therefore they require the means to be provided of having recourse to a master, who can instruct them in the working of the fabric, whatever it may be, to which their pattern has been employed. In France the workman is more an artist than in this country. The system in France is very different, because there the artists of the first eminence employ their time, and make it the most profitable part of their employment in pattern-drawing, and they are paid a very high price by the manufacturers. There is a legislative protection to their work, which in this country we have not, and yet it is of great importance; so that for a year (I believe that is the period) both the manufacturer and the artist is quite sure of his pattern not been pirated. It appears to me, that some legislative interference in that matter would be almost necessary to go hand in hand with any establishment for encouraging the art of design amongst the middle class of society in this country, that they may be protected in the production of their genius; otherwise neither the manufacturer can afford to risk the loss of the pattern, or to pay a large sum for the pattern which he may lose, nor can the artist risk it. On general principles, it would be exceedingly desirable that a speedy and cheap remedy should be given to the inventor of a design; a small sum to be paid for the right of proprietorship. It appears to me that one thing in which the British manufacturer is most deficient, is that of a knowledge of colours; at present, as far as my acquaintance with manufacturers goes, I believe they copy entirely their patterns from France; in doing so, if they introduce any alteration into them they often spoil them; and it is a matter which is not a very difficult one to obtain a knowledge of, the theory of colour; but it is one which appears to me a very singular circumstance that it is not sufficiently attended to, because we know quite well that any deviation from the regular established and fixed rules of harmony of colours, produces the same effect to the eye as any deviation in music from the harmony of notes. It produces an equally bad effect; and in placing our manufactures or fancy goods along with French fancy goods, it has often struck me as a remarkable circumstance to see how very little those rules which are exceedingly simple, are attended to in the English copies. That was my reason for suggesting a lecture on that part of the subject, on optics, in fact, on colours, at those schools; for the rules are simple, but quite necessary to be known to any person who has occasion to place colours in juxtaposition. The funds of the Board have been very much reduced this last year; they are now exceedingly small, but they are at present engaged in measures for the extension of that very object, because it appeared to the members of the Board that that was the most essential requisite for the improvement of our manufactures, because it is obvious to every one that in point of excellency of workmanship the British manufacturers have risen to the highest pitch; it is only in the taste of design in which they are deficient; therefore the Board of Trustees have particularly directed their attention to that subject, as their funds have been so much reduced that they do not see they have the means of doing much else. In the course of this ensuing winter I expect that a good deal will be done on the subject. The French pattern-drawers have the flowers before them. I believe, in this country, when they do make patterns, which is not very often, they take any book of travels containing flowers, which may or may not be correct; but I know the French artists copy from the flower itself, and that, being in the hands of skilful persons, it is always botanically correct. Academies might not only be connected with botanic gardens, but also, to a certain degree, with institutions in surgery; for instance, anatomy and other branches connected more particularly with science and art; how it might be brought about, I am not quite aware, except by employing persons; there are only professors; I am perfectly persuaded of the advantage that would arise from it: I think the improvement in matters of taste in general has been very remarkable in Scotland within a few years, and in dyes there has been a very great improvement; since the Board of Trustees have given premiums for that special purpose, there has been a very conspicuous improvement. In patterns the improvement has also been obvious, but not so very great as yet, because there is no instruction given in it; the young men who present these specimens of drawing are left to themselves, and they frequently go wrong in many particulars; it appears to me there is a great deficiency in the want of instruction. The Board of Trustees give 24*l*. a year to be divided into prizes for the young men. There are six prizes for ornamental drawings, and six prizes for drawings from the round. The young men produce the first and the last of their performances during the season, in order that the Board may be able to compare their progress; and these are kept in the possession of the Board, not returned to the young men. They are also exhibited to the public. The prizes given by the Board of Trustees for improving manufacturers' patterns, are very numerous, and vary from year to year, according as the state of manufactures and the state of the demand for manufactures seem to require, also according as it appears to the Board that there are particular branches of manufacture which might be conveniently and advantageously introduced into the country; therefore the premiums which they have offered have varied from year to year. Their principle is, that they shall not continue to give premiums for a longer period for the same purpose than what is quite sufficient to introduce it; when once it is introduced they suspend the premium, because they consider that if it cannot maintain itself after that, it is not worth encouraging. Formerly there were a great many premiums given for the purpose of the linen manufacture; these have now been suspended. There are many premiums given for the woollen manufacture; for all the branches of that manufacture. Within these two or three years the Board have particularly turned their attention to matters connected with woollen manufactures, to the branch of carpet manufacture; and they have been the means of very much extending that branch in Scotland by the introduction of three or four new descriptions in the branches of manufacture which never were known in the country before, never practised in Scotland at least, and which have been most successfully introduced, and are now rising into great reputation. They have also turned their attention particularly to the subject of the shawl manufacture; a number of their premiums were dedicated to the shawl manufacturers, and amongst others, being aware of the disadvantage which the shawl manufacturers were exposed to from drawing the yarn used in that manufacture from France, and from France alone, because it was only there where it could be spun, the Board of Trustees offered a high premium for the introduction of the art, and have succeeded in introducing it; and it is now established in Glasgow and Leeds to an extent which I believe now supplies the market as quickly as the French agents did, who do not come now to this country for that purpose. The amount of the premium was 300*l.*; it was the largest premium which the Board ever offered for any subject, and they consider they have done a very great benefit to the country in having succeeded in that scheme. They have introduced the system of making carpets in imitation of Turkey carpets, because they are made of coarse wool, which is more suitable. Their view was the consumption of Scotch wool, which is coarse wool compared with the wool of England, Saxony, and other countries; the view of the Board was to extend the market for the Scotch wool, and therefore they introduced the manufacture of Turkey carpets, which has been exceedingly successful, and has very much increased the consumption of that staple of Scotland. They then extended it to the Persian carpet, which *is a different fabric also, and that has also been successful; there are a great many looms now employed solely* upon these branches. I cannot altogether say, but I believe the carpet manufacture has very much increased in consequence of the introduction of all those different branches. They introduced also the tapestry mode of making carpets in imitation of French carpets; they also introduced the making of carpets from cow-hair, which is an article that formerly was not used in any shape but in that of mixing lime; in fact, it was of no use; the premium was offered about three years ago; the yarn was spun generally in the gaols and correction-houses, and those sort of places, by the people who were there; and carpets have been produced of exceedingly good workmanship, and very useful for many purposes, particularly for shops and for lobbies, and purposes of that kind. It is a coarse manufacture, but a very useful one; it is altogether peculiar to Scotland; the idea, in fact, occurred to myself; I had seen the use of cow-hair in making rugs and things of that kind in Flanders; and I suggested that improvement, and it has been adopted. This improvement applies to the texture; the design is that of the Turkey and Persian carpets, but that has improved the art of design a great deal, because being a new subject, the artist has bestowed a good deal of attention on the subject. The French design is what is called tapestry carpets, which has also been introduced into Scotland. The Scotch have now imitated that French pattern, I think with very considerable success. Those require botanical accuracy above all things, because they generally are groups of flowers thrown down on a dark ground; and there is a much greater variety of shades of colour. Formerly in the Scotch manufacture, and I believe in the English also, they could not introduce above four colours, except by mixing the threads; except by mixing a thread of two different colours. I know that from a circumstance which was mentioned to me by a colour manufacturer in Scotland; he had arrived to the extent of introducing fourteen colours, or tints, which was conceived to be almost impossible; however, he was a very ingenious man; his name is Whitock, and he set himself to work, and he has very much augmented the number of colours now introduced into patterns. In that respect, and in the circumstance of design and the beauty of execution, I think he stands pre-eminent. He has obtained a patent for the velvet carpet. The Royal Institution is now connected with the Board of Trustees, in consequence of an arrangement which took place about four years ago. Therefore the Board of Trustees have obtained access for their pupils to the library, containing works on the fine arts, and every thing connected with that subject; they also have the privilege, for the pupils of the academy, of attending their gallery of pictures, and copying pictures there, and studying as they choose. The Institution have no casts; it is merely confined to pictures; it is a private institution supported by private subscription, and they have expended the whole of their funds in the purchase of the pictures of the old masters, of a collection, not a very large one, but an exceedingly good one, of paintings, which is now open to the pupils of the academy of the Board of Trustees. The gallery of casts consists of about one hundred excellent casts of the finest works of antiquity; they have also the Elgin Marbles, and have received a number of presents and legacies of different works of the same character. They obtained the originals from Lord Elgin; a great many of the casts which he had taken at Greece of different buildings, which are now in the collection of the Board of Trustees, are open to the public; to the artists always; to the public on certain days, but always to the artists, and always to the pupils of the academy at all times. Exhibitions of works of art, such as ingenious patterns and manufactures, or ingenious specimens of weaving, were, at one time, contemplated, but never put in practice. I understand that there exists an indisposition on the part of persons who have made inventions or improvements to exhibit them, from the circumstance that they are aware that they have no protection; that their invention and the property of their improvement is not protected. The Trustees, for the encouragement of the manufactures of Scotland, offer annually a series of premiums for improvements in different manufactures, also for inventions, should any take place. Those are annually exhibited to the public, and judges are appointed from among the manufacturers, who examine the goods and award the premiums. The circumstance that induces the manufacturers to attend very much to that is, that by obtaining the premium for their manufacture, they obtain the means of publishing, very much to their own advantage, the species of trade that they carry on; otherwise the premium is a very small one, and scarcely worth the while of a manufacturer to work for it. The French Exposition is highly advantageous. Where it enjoys a very great advantage over any attempt in this country, is that the improvements of the year, and the inventions of the year, are by the French manufactures expressly reserved for that exhibition, because they know that they are safe in producing their new design, whatever it may be.

John B. Papworth, Esq., Architect, examined:

I think the defects in art, as applied to *manufactures, chiefly arise* from the want of protection, because there are a great number of clever artists in this country, sculptors, for instance, who would occasionally model a tablet, a frieze, or some other work of art, would cast and sell the work in such numbers as would produce remuneration to the artist; but if he were now to let one such cast pass out of his hands, it would be sold probably about the streets in a week or a fortnight for 2s. or 3s. He is not protected sufficiently to allow him repayment for the work that he performs with so much care and study. In this country, if an architect wanted to find a modern vase, a modern tablet, or a modern frieze of very fine art, he might therefore seek it in vain. A student must first make himself capable to produce works of fine art, and much time and instruction is essential to this attainment. Then if he were encouraged to proceed by knowing he should be paid for that which he published, he would employ his talent, or it would find employment; but feeling he shall not be remunerated, because ornamental art is not adequately protected, he does not sufficiently cultivate it, and the public loses the benefit of his talents. The supply of designs from foreign markets is the effect of the want of instruction in the pattern-drawers themselves. I will imagine that a piece of silk is brought over to this country, and is seen and looked at; the merchant approves and sends it to the manufacturer; the consequence of which is, there is no employment for a draughtsman or a designer for that piece of work, and the articles that are so introduced pass to almost every manufacturer, and shut out the employment of original designers. The absence of protection has induced manufacturers to seek a style of ornament capable of being executed with facility by workmen unpossessed of theoretical knowledge, and without practical accuracy. This style has been fostered to a great extent, and erroneously termed that of Louis XIV., but which, in fact, is the debased manner of the reign of his successor, in which grotesque varieties are substituted for classic design; and it is admitted that designers and workmen of very mediocre talents are preferred to better artists in this kind of work, for it is little amenable to the criticism of the judicious, and the workmen are usually free from the trammels of artist-like education. The early style of Louis XIV. was a very bold, a very sumptuous, and a very grand style; it was adopted with avidity, and there was a great demand for it in his magnificent reign; it thence became debased, even in that reign, by the employment of meaner workmen; but the grand designs of Louis XIV. were essentially different from those of Louis XV. In the early part of Louis XIV. it seemed as though the Roman style was not sumptuous enough for his purpose, therefore he demanded designs of a more extravagant, a bolder and larger character, and of more sumptuous expression than the Roman style afforded; but the Roman and Italian styles, made more sumptuous, is the style of Louis XIV. The pure style consists of such works in ornamental art as were executed by the Grecians, Romans, and Italians, and which have long been accredited as the offspring of high and cultivated taste, and as practised by Michael Angelo and Collini, as designed by Le Pautre and others, and given in valuable documents by Piranessi; this style is almost lost to this country and to its manufactures. As a means of reviving, or, rather, creating, a pure style, I have, in conjunction with other professional men, been very much concerned in forming an institute of British architects, which has now got into operation. The very views which this honourable Committee take, had already influenced the members, and who were not aware that this subject was likely to occupy the attention of the House of Commons. In that institution we shall endeavour to improve the art of design from fine examples, getting together a collection of antiques, and offering rewards, not merely for the copying those antiques, but for composing new designs in that spirit. We have no school, but we propose to have lectures upon the subject, and I believe it will be very soon established, so that we shall have good modellers for the students, or rather, I should call them, the younger members. They can draw already, we shall have good modellers for the purpose of teaching them how to do works by their own hands, for when they have learned that, we shall find them able to instruct others whom they may employ. I think that result would follow of course, but such means of improvement as may follow the labours of this Committee, I think most likely to assist artists in every way, and the benefits of which will pass through the whole manufactures of the country. The institute of British architects was founded for the purpose of facilitating the acquirement and diffusion of architectural knowledge; for the promotion of the different branches of science connected therewith; for establishing an uniformity of practice, and maintaining a high respectability of character in the members of the profession; numbers have joined it. We have had some large donations from gentlemen; and we have thence felt that we could carry it much further, and purpose to foster the art of design as much as we possibly can. The limiting bricks to a particular size and a particular form, is a great drawback, as the material of which brick and tile is composed is capable of receiving *an impressment of mind upon it, and to great extent and variety. I have no doubt that permission to* make them in any form would be a great benefit to architectural beauty. Lombardy brick is introduced in combination very nearly as beautiful as any thing that can be made of stone. There is much of beautiful form and useful work that might be executed if the manufacturers of bricks were allowed to make them of any form they chose; but for general building I am not aware of any forms so good as those now in general use. If it were not for the high duty on plate-glass, and the duties paid on glass generally, glass would have been made a material to exercise art upon, more extensively than it has been. One of the great preventions in introducing coloured glass particularly, is, as I am told by the manufacturers, that they may not melt less than a certain large quantity of any one colour; therefore, if it is for small articles that they want it, or for one small article, they are perfectly prevented from using it at all. The window-tax also, in limiting the number of apertures, and restricting their size, had an exceedingly injurious effect; and in the proportion and the beauty of buildings altogether, architects find very great difficulty in adapting size and proportions, so as not to infringe upon the limitations prescribed; perhaps when they want very different quantities.

Mr. Philip Barnes, examined:

I am connected with the Norwich Society of Artists for promoting the knowledge of Drawing, and have been for the last twenty-five years. The institution itself is not connected with the manufactures, but since the establishment of an academy of art, which is attached to the Norwich Society of Artists, it might be so connected. The institution itself was established in 1803 as a Society, and first had a public exhibition of the works of art by the members and their pupils in 1805; which public exhibition continued annually till 1833, when, by the death of some of its members, and the withdrawing of others to the metropolis, and the want of patronage and other causes, over which we had no control, we were obliged to suspend the exhibition for the present from that period. The society itself is the oldest provincial society out of London; and I believe it is the only one that has maintained itself, after struggling with great difficulties. It is supported principally by the exertions of the members themselves. It has existed about five years, in consequence of the corporation of Norwich presenting the Society of Artists with the sum of 100*l*. to purchase a collection of casts, with a view to have it as an open and more public establishment. The society has extended the number of casts, and expended other monies besides that given by the corporation to establish this academy; but the expense of conducting the academy is now sustained by the pupils themselves, at a rate of pretty near 4*l.* a year each. There are six pupils at this present time; and those are adults; there are no masters. The artists themselves attend and give mutual instruction. The manufactures of fancy fabrics of Norwich, the shawl and silk dresses, and fancy goods generally, would be much benefitted by the establishment of schools of design and museums.

Charles Robert Cockerell, Esq., examined :

I am architect to the Bank of England, and an associate of the Royal Academy. I have experienced great difficulty in procuring assistants in executing the ornamental part of architecture. In our business we have occasion chiefly for ornamental plasterers, carvers in wood, marble, stone, casters in iron, moulders of iron, chasers in bronze, and ornamental painters, &c. &c. I find that we have had a very great dearth of late years (at least fifty years or more) of artists to fulfil those duties. I believe that to have arisen from a change of taste in a great measure since the beginning of the last century, especially the time of George II. and Louis XV. and the introduction of what was assumed to be the Greek and antique taste under Adams the architect, Chambers and others, when cast-work was very much introduced into ceilings and walls, cast-work in putty decorations on wood instead of carving on wood, which abounded under Grinlin Gibbon, and under the architects of Queen Anne's time. I apprehend that the system of cast-work and mechanical process has displaced the florid and more elaborate style of our ornamental work; and, I believe, that the attempt to supersede the work of the mind and hand by mechanical process for the sake of economy, will always have the effect of degrading and ultimately ruining art. Formerly, for instance, it required a long apprenticeship to acquire the system of ornamental plaster-work, done by the hand in ceilings: there were artists that were brought up from childhood and passed their lives in that occupation; there is not one now to be found in this country. A few of those exist in Ireland still; but during my knowledge of practice, which has been for upwards of twenty-five years, I may say that we have had but two or three modellers, at the same time, who have been capable of executing well the matrix from which these ornamental cast-works are done; a Mr. Bernasconi till 1820, Mr. Rogers, and more recently Mr. Nicol; and the consequence of the paucity of hands, the delay and the difficulty has been, that architects have been deterred from the introduction of ornamental works of this description. Within the last few years, however, an improvement has taken place, from more universal acquaintance with fine examples on the Continent, the prosperity of the times, great competition and other causes. Some years ago we had an ornamental painter, Mr. Dixon, but that art has ceased, and is altogether lost; and this is attributable, in great measure, to the introduction of mechanical art, generally termed polygraphic, as, for instance, all kinds of papering, carried on in France (to which country the observation may also apply) still farther, in the execution of historical subjects, landscapes, &c., in papering, which are well known. I have given my attention to manufactures as applied to architecture, as, for instance, brass works, applying to balustrades, furniture of doors, grates, stoves, plate, cutlery, and similar works done at Birmingham, which an architect is often called upon to direct. I have found that, from the ignorance of the true principles of design, there is a constant waste of capital in the capricious and random endeavour to catch the public taste; I have freely commented upon this deficiency, and have generally found it confessed. The manufacturers are not sufficiently impressed with the necessity of a higher culture of design; they generally dabble themselves, and put things together from books; they purchase books of design with avidity, and I have known them buy up the stock of a bookseller to secure the exclusive advantage of a rare publication of patterns. Some years ago, his Grace the Duke of Northumberland had the liberality to lay out a large sum in his house at Charing-cross, on manufactures wholly English, and of unusual magnificence. I followed the execution of these in various manufactories, and found them always at a loss for design and models well understood, and confessing, according to their own words, the deficiency of the master hand. As regards porcelain, foreigners are superior to the English in flower-painting and ornamental scroll-work, and the blending of the gold with the proper colours. First of all, I conceive the beauty of the porcelain must depend upon its form, and its contrivance; for instance, the works from China, in which we see animals introduced, not only with a view to ornament, but for real utility, as handles, feet, &c., as also in the antique vessels in pottery or bronze, we constantly observe an admirable adjustment of such useful and ornamental portions of the work, full of taste and meaning; and, secondly, the of beauty of porcelain must depend upon the arrangement of the design, and colours painted upon it. My friend, Mr. Isabey, the miniature painter to Napoleon, was occasionally employed at Sevres; his talent, which is the first in France, had been employed by the Government in historical painting, and portrait and ornamental painting in the china works got up at Sevres. I may add on this subject, that amongst a large acquaintance I made at Rome of French artists brought up at the Academy (of whom I think there are from two or three painters sent annually from Paris to Rome to study, and of those men I think I have known about fifteen), there are not above three or four who have become celebrated, the rest being very accomplished men, but scattered throughout the provinces of France, and transferring all their knowledge to the different manufactories and provincial schools. I have seldom heard of these men, except that they were living in their own provinces, without much fame in the upper branches, but their skill honourably employed in assisting various manufactures. I have considered the relative state of arts, as applied to manufactures, as compared with England and the Continent, and I apprehend that the object of legislation on this subject must be the multiplication of industry and commerce, as well as to give splendour and do honour to the country. The Governments of the Continent have been always better and more systematically directed to arts and manufactures than by our own scattered endeavours, especially in the higher departments, by establishment of professors of archæology furnishing the learning necessary, academies providing accomplished hands, by premiums on manufactures, direction of some of them, by exhibitions of art of all ages gratuitously, thus diffusing taste through every class of society from the manufacturer to the purchaser. The result on my mind has been, a conviction of the necessity of such means in this country as they have on the Continent, which, superadded to the capital and industry of this country, would give us the superiority over every other in arts and manufactures. I have already cited Mons. Isabey and the French academicians as instances of talented artists applying themselves to manufactures. In this country I know that Mr. Briggens, a very able artist, established himself at Birmingham, but though fully qualified, he did not succeed, and left the place about ten years ago. This I must attribute to want of discrimination in the public taste as well as in manufactures, since they would have paid for design if worth their while. However, all experience, both in ancient and modern times, shows, that, if able artists confer advantages on manufactures, [they,] in their turn, have often produced great artists. I do not think a knowledge of correct drawing, proportion, and perspective, compatible with the occupations of artisans, and the encouragement to it would mislead them, and interfere with their proper callings, and right division of labour, in which excellence already requires all their ability. There is a wide distinction between art and fine art; in the latter, the knowledge of artisans whose bread is earned in laborious work, must be always very limited, compared with those who have an original genius for it, and have been brought up in the highest scoools, and with the best opportunities of instruction. This knowledge is a science of itself, and requires a life to attain. There is every respect among artisans towards men of superior knowledge, they bow to them, and follow them implicitly if they have reputation for merit; but I apprehend that any attempt at a general diffusion of the higher principles would be futile. Those principles may be, in a measure, imbibed, by the constant view of fine objects, and the encouragement of men brought up in higher schools to instruct in the lower branches of arts and manufactures, would be, in my humble opinion, the best course. I have designed for Rundell and Bridge, at the time they employed in the same occupation Mr. Flaxman, Mr. Stodhart, Mr. Bailey, and Mr. *Howard*; and one of those gentlemen specially attached to the concern received a salary of 500*l.* a year, and a house to live in, and a portion of his own time to employ in his art, not in their interest, and apprentices who working under him were separately charged against the house; and I had occasion to know that they spent in designs alone 1,000*l.* a year and upwards, and quite as much more in the higher order of chasing, and the execution of ornamental works. In illustration of the magnificent and enthusiastic patronage of manufacturers, and the honour and advantage they confer upon their country, I beg leave to mention an anecdote of the late Mr. Wedgwood, related to me by Mr. Cumberland, of Bristol, who wrote a pampblet in 1792, recommending a national gallery of sculpture, casts, &c.; in aid of which Mr. Wedgwood made a tender of 1,000*l.* I beg further to say, that I have found Wedgwood's works esteemed in all parts of Europe, and placed in the most precious collections of this description of works. The house of Rundell and Bridge has suffered most materially from piracy. It was but recently I had occasion to see a very eminent floor-cloth manufacturer, and who stated to me that his designs were copied within a few weeks after he had issued them, by a cheap house in Bristol. These gentlemen express their obligations for the designs, but they say, "we cannot continue to employ you, because we have no protection for the designs after they are made." I understand also, that wherever questions of patent have come before the Court of King's Bench, there has been a disposition always on the part of the jury to favour the liberal construction of the case, as they conceive it, and to oppose exclusive rights; so that a person in defending his patent is very much discouraged. The Excise levy a great increase of duty upon bricks moulded out of the common way, being 5*s.* 6*d.* on common bricks, and 9*s.* per 1,000 on bricks exceeding the common size in any dimension, so as to dissuade architects from the use of moulded bricks in their works. The celebrated Sir Henry Wotton complains of the want of knowledge in this respect in England, observing that there was generally too much of the material of bricks in the makers. I would wish to offer, with great deference, my opinion on the advantages derived from galleries of casts of classical objects in sculpture, in parts of architecture, vases, casts from bronzes and from fine works of all periods, botanical gardens and museums of natural history, open to the public, which, wherever they do exist, I have observed to be extremely frequented by the public in this country. I have seen and watched with very great interest the establishment and growth of institutions for the encouragement of the fine arts in Dublin, Edinburgh, Bristol, Birmingham, and many other places; these have been raised by the subscriptions of individuals, often manufacturers themselves, very enthusiastic for the honour and for the real improvement of their native towns; but the means being very small, they have been obliged to support them by the attractions of fine art and annual exhibitions; they have not been able to bring them to bear more directly on manufactures to such an extent as they otherwise might have done; and I doubt not that if those institutions were in a situation to add to their means, by the encouragement and aid of Government, afforded under proper conditions, and were enabled to give rewards, and to hold out premiums for works wholly applicable to manufactures, that the original promoters of those institutions would be gratified and stimulated, and the ultimate objects of those interesting schools would be fulfilled; a permanent solidity would be given to those occasional and fluctuating efforts of enthusiasm or prosperity, of which we see so many examples, and the Legislature would obtain the desired effect at a much cheaper rate and more effectually, than by any other means I have been able to contemplate for the general improvement or application of art to manufactures. I am acquainted with many of these schools. I was in Birmingham the other day, and saw that since my visit eight years ago, a very respectable academy had been established there; and there are from eighty to one hundred young persons learning drawing belonging to that academy, as well as independent schools, as that of Mr. Line's. The pupils are sons of artisans and tradespeople. Several schools are to be found in London, where instruction is given in the rudiments of drawing required by joiners and other artisans at a very low rate; but they are all on a limited scale, being started by individuals. I have a firm conviction, arising from long acquaintance with the subject, that there is a superabundance of artists in this country, and for one who thrives, a large proportion are without employ; and that the unsuccessful class are not so well paid as good mechanics. In this country there is a great propensity to art, and its attractive nature will always supply abundance of artists; but they have not been directed in a course to apply their art to manufactures, from the causes above cited, especially the want of scientific means, and an encouragement to this end, and legal security in their patterns.

M. Felix Bogaerts, Professor of History at Antwerp, examined:

There are a variety of means adopted for giving the people of Belgium education in the arts. Our first schools are the Sunday schools: in them the children of the poor are instructed to the number, in the city of Antwerp, of from 7,000 to 8,000. Instruction is given not only in reading and writing, but also in design. The children educated in such schools, are therefore qualified (so far as their future occupation may be connected with the arts) for the exercise of such occupation. Since the institution of these Sunday schools the intelligence of the people has been greatly developed in reference to the arts. Those children in the Sunday schools who show a disposition for the arts, are encouraged to pursue it. Not only, therefore, do they find encouragement in the workshops of the manufacturer, but (if they have a taste for superior art) in the studio of the artist. A vast number of painters at Antwerp have risen from the lowest classes of society. The next step is taken in the academies. The fine arts are taught at the academies; but that part of academical instruction which is devoted to manufactures, is only feebly developed in them. The professors are paid by the city or town in which they lecture. Of all the schools of the academy, that which is most frequented is the school of architecture. There they learn perspective, the interior decoration of houses, and various branches connected with internal and external architecture. These means have much improved the taste and manufactures of Belgium.

Charles Toplis, Esq., examined:

I am one of the vice-presidents of the London Mechanics' Institution, and I am also director of the Museum of National Manufactures in Leicester-square. In Paris, the splendid collection of the Louvre is open to any applicant there to study, to make copies from the pictures and from the statues. In Bordeaux they have a similar collection, not upon the same scale as the Louvre, but they have a collection of pictures and of statues which are also open to any applicant to study. In Lyons, I believe, their schools are more expressly directed to their peculiar manufacture, namely, the silk manufacture. I believe it is the case in their university schools, that they are open indiscriminately to all students. The university of Paris and the medical schools are there open. They have also schools for the training of artisans; they are at present re-modelling or rather re-organising, I should say, the Conservatoire des Arts et Metiers, and there is now a series of models made by the pupils of one of these schools, which are made in a creditable and workman-like way: that is, they are made to scale and correctly finished. They are going on to complete an entire collection of all the most useful machines that are employed in great works and in manufactures. Originality of design is very scarce, and in England art is chiefly confined to copying. I can give an instance of that; the common earthenware manufacture takes its style of ornament from China, that was brought over here many years ago; they still continue that barbarous style of covering which the Chinese had adopted. A very great improvement has been recently made in the means of multiplying the copies of designs for transfer to the surface of the ware, by printing off a continuous sheet, and such is the constant demand, — but this comes from the bad taste of the public perhaps,—such is the constant demand for the old Chinese barbaric ornaments, that they have been obliged to engrave their cylinders in the new machines to those patterns, though they have at the same time brought forward much more tasteful designs of their own; but still the great demand by the public has compelled them to adopt the old rude style of ornament. I know one house now that has had in hand, I think for at least four years, a service of porcelain for the King, and it has been retarded in its finishing a very long time by the manufacturer's inability to procure a sufficient number of first-rate hands to do the painting upon it. I lay down as a principle, that having instructed the artisan to a certain extent in the general principles of design, I would then allow him to confine his attention to the particular branch of manufacture to which the design is applicable. I should take a man perfectly conversant with *that branch of the business*, and *give him the pupils, and say*, "Now you take those pupils, and instruct them in all that is necessary for this particular department;" in the instance of porcelain he would say to him, "You have been accustomed to use such and such colours, which are at once obvious to your eye; you know the colours you are going to apply to your picture by their appearance on the palette, and you know they will have the same effect to the eye which they have upon the palette; here you are going to encounter a totally different principle; you are taking a colour which is totally different in appearance to what it will be when it has been subjected to the process of burning. This is perfectly new to the student; he then has to be instructed in and shown what are these changes that take place in the colours in the operation of burning. This is a preliminary training which he must necessarily go through." Then there is the effect of different fluxes upon the colours, the effect of the different combinations of colours, the quantity of flux that is necessary for one colour and is necessary for another that are to be exposed to the same degree of heat; the colours that require different degrees of heat; and all these technical peculiarities must be taught to the general student of design. He is only qualified before he comes there by training of the eye and the hand; his eye can measure forms and trace their contours, his hand can make the copy upon a plane surface of those forms; for in the iron foundry, for instance, the student who had been taught to draw ornaments upon a flat surface, appropriate to that kind of material, would have to be taught when he comes to apply himself to this particular branch, that all kinds of forms would not be admissible; they would not deliver from the sand; he must have a peculiar knowledge of what will and what will not be manageable in the hands of the moulder, and then he comes to a peculiar technical training. That is another instance, and I fancy it will be found generally to prevail all through.

Mr. Joseph Clinton Robertson, examined:

You conduct the *Mechanics' Magazine*?—I do.

How long have you conducted it?—From its commencement, about eleven years ago.

Has it diffused a great deal of information among the artisans of this country?—I trust it has; it has a very extensive circulation.

Have you had an opportunity of observing whether there is a want of drawing among the working mechanics?—I should say there is a very considerable want of a knowledge of drawing; but I would qualify the observation in this way:—it is not so much an ignorance of the uses of drawing, its intent and meaning, as a want of personal skill in the practice of it. I have scarcely ever found among mechanics (and I have had intercourse with a very great many) an instance of their not being able to comprehend perfectly any geometrical drawing that was submitted to them. It is a common saying among them, that they can comprehend any form of construction better from a drawing than from the best written description. Indeed, as most of them work from drawings and patterns, it is absolutely necessary that they should be able to do so. They can read drawings, if I may so speak, and understand them thoroughly, though they cannot themselves draw; just as many a man can read and understand our best authors, who, if he were himself to take pen in hand, could not write a single sentence grammatically. I may add also, that I do not think it is from want of opportunities of acquiring a knowledge of drawing, or from any neglect of those opportunities, that the majority of mechanics are thus ignorant of drawing, but because they have had no occasion to practise the art.

Why have they had no occasion to practise it?—It seems to me to be but a necessary result of the great extent to which division of labour is carried in this country. Every man of the working classes looks out for and studies that branch of art only by which he expects to get a living; he confines himself to that alone. Take, for instance, the case of any large manufactory; it does not require probably above four or five good draftsmen to keep two or three hundred men constantly at work. Of course, it would be labour thrown away for the great body of those men to acquire any greater knowledge of drawing than is requisite to enable them to comprehend the designs entrusted to them for execution.

Do not you think it would be of advantage to every mechanic to be able to draw?—I think it would be a great waste of time in any mechanic to learn an art that he could not turn to some practical account; and I think that it is from a conviction of this among mechanics themselves that they refrain so generally from cultivating drawing.

Is not it a deficiency of the system that in that general division of labour there should not exist classes occupied in adapting the principles of design to general use?—I believe that in every trade there is a natural demand for designers, which produces as many designers as are wanted.

Are those designers sufficiently instructed?—I think they generally are sufficiently instructed. I have never met in all my experience any want of talent in designing in any branch of manufacture.

Have you ever had an opportunity of comparing the designs made here with the designs made in France?—Not from visiting the workshops of France; but I have seen numerous French publications of works of art, and such specimens of French art as have been imported into this country, and I do not consider that we are behind our neighbours, except in a very few branches.

You do not consider that we are in general behind the French in design as applied to manufactures?—Not behind the French, certainly.

On what facts do you ground that opinion?—On the proved ability of the English artisan to do any thing you can put him to as well, if not better, than any other artisan in the world, provided only you can pay him what he calls living wages for his labour, which are, unfortunately, with us much higher than in any other country; and on the fact, that many of those fine designs for which the French have the credit are in reality the productions of our own mechanics. You commonly hear it said that the patterns of French prints are much superior to ours. Now it is notorious (abroad at least, if not at home), that most of the engraved cylinders used in France are supplied from this country. A friend of mine went into a mercer's shop in Paris, and was shown there some very beautiful printed cloths—chintzes, I believe; he dropped an expression of surprise that our English manufacturers could not produce such elegant patterns as those he saw before him. The shopman smiled and replied, "To tell you the truth, sir, the cylinders from which these cloths were printed came from Manchester."

That applies to the printed cotton manufacture?—Yes, to that particularly.

Do you mean to extend that observation to all the more fanciful description of goods in which design more peculiarly enters, as well as to the cotton manufacture?—I really do not know how to limit the observation, for though the French do perhaps excel us in fancy goods, I think this is more owing to the talents of our artisans being employed in a more profitable direction, than to any inferiority of taste in them. The great object with every English manufacturer is quantity; with him, that is always the best article to manufacture of which the largest supply is required; he prefers much a large supply at a low rate to a small supply at a higher; and that even should the present profit be less from the former than the latter, because, in the long run, the larger the demand, the steadier it is sure to be. I do not think this is a point which has been sufficiently considered. From the great command of capital possessed by the English manufacturer, the immense capabilities of his machinery, and the unrivalled skill and industry of his workmen, he is enabled to turn out a greater quantity of goods in a given time than the manufacturer of any other country whatever; while our wide-spread commercial relations present him with facilities of disposal such as no other manufacturer enjoys. He lays out himself accordingly to supply those manufactures that are most in demand all the world over; and those that are the most in demand among mankind at large will in the nature of things always be of the least tasteful description, that is to say, till the bulk of mankind are much more cultivated than they now are, or are likely soon to be.

Do you think that if they exercised a greater degree of taste upon the same material of manufacture there would be a greater demand for that manufacture?—I doubt that very much; the taste, such as it is, does not seem to be any drawback on the demand. You must improve the public taste greatly before you can expect to witness any material improvement in the productions of those who minister to it.

How would you improve the public taste? —That is the question for consideration.

Is not the public taste improved by the sight of works of good design?—Decidedly.

Do you suppose, if works of good design went into the market with works of bad design, that in the end the works of good design would not be preferred?—I am not sure of that; I think the public eye requires to be educated in matters of taste, in the same way that the understanding requires to be enlightened by reading and study.

Do not you suppose that the public eye is enlightened, in matters of taste, by the exhibition of well-designed works?—No doubt; the more habituated the eye is to the contemplation of beautiful forms, the less relish it will have for the grotesque, the gorgeous, and the glaring, in which rude and vulgar natures delight; and hence the superiority of the educated and travelled classes in all that regards matters of taste; the same pattern which, for elegance of drawing and delicacy of colouring, would be appreciated, and, because appreciated, universally sought after in the west end of the town, would, in all likelihood, be passed over unheeded, if not contemned, in Wapping, or any similar neighbourhood.

Is it not the inference from that, that it is desirable to improve the taste of the persons at Wapping, who do not so highly appreciate that which is well designed?—Most desirable, certainly; the taste of the entire public wants improving; but as regards the mechanical classes, I think they are rather before than behind the public taste in this respect.

Then how do you account for the circumstance which has been stated in evidence to this Committee, that many patterns, particularly in the silk manufacture, which are brought over from France, are greedily sought for, and copied, in preference to those of our own workmen?—I ascribe the demand for French goods partly to a taste, a vulgar taste it may be called, for what is far-fetched and high-priced, partly to the actual superiority of the French patterns, many of them derived, as I have before stated, from an English source, and partly to fashion, for which you can often assign no reason whatever. A cylinder, engraved at Manchester, is sent to Lyons, and the article printed from it comes back here, and is very much in request as a French pattern among persons who know nothing of its history, because, of course, the person that supplies the engraved cylinder to the French manufacturer, does it upon the understanding that he will not make the pattern engraved on it previously known in this country.

Then you do not admit that any actual superiority, in point of taste, exists in France? —I do not know any thing that our artisans are not capable of producing, taking this always into consideration, that the price of food in this country is such that it will not allow them to devote to many descriptions of work the same length of time which foreign artisans, with their cheaper means of subsistence, can afford to expend upon them.

You have said that at the west end of the town you think there is a better taste than at Wapping?—Unquestionably; it is a highly educated taste; the best of which the country can boast.

At the west end of the town, do you, or do you not, find the goods of foreign manufacture more in demand than at the other end of the town?—I believe they are.

Then how do you reconcile that with the opinion you have expressed, that the English manufactures are equal in taste to the French? —That is not exactly the opinion I expressed; I have admitted that the French do probably excel us in fancy goods, but I claim for our English workmen the merit of producing many of those patterns for which the French get credit; and I claim for them also the ability to do any thing which any other artisans can do, if you will but make it worth their while.

Do you then suppose that all the French goods that come here are founded upon English patterns?—Not the whole of them, but I apprehend that a great part are.

Do you suppose that a great part of the fancy silks which are consumed at the west end of the town are founded upon English patterns?—Not the fancy silks; that is a branch of manufacture long peculiar to France, and which, for various reasons, is as yet but in its infancy in this country. My observations have reference to the various cotton and linen fabrics, in which the arts of design may be carried to as great a degree of perfection as in silks.

Are they carried to as great an extent as in the Jacquard loom?—They are not, but they might be.

With respect to various articles of manufacture in which the fine arts are exercised, for instance, the time-pieces and figures in or-mulu, candelabra, and various articles of that kind, which are formed upon classical models of the antique, are they principally the work of English artists, or do they come from France?—I believe the greater part of them come from France; but I am satisfied our artists could produce equally good articles of that description, if we could afford or chose to pay the higher price, which would be requisite to remunerate them.

Why must they have a higher price?—Because provisions, and consequently wages, are high.

How comes it that we can undersell them in cotton goods?—Because machinery has here to a great extent superseded human labour, and because in the case of cotton goods there is an immense supply to compensate the manufacturer for low prices.

Then there is not a demand for fancy articles of the kind mentioned?—Yes, a demand for them among the higher classes, but little disposition on the part of English manufacturers to embark in the production of them; they prefer turning their attention to things of a more ordinary description, which every one wants. It was mentioned by Mr. Toplis, that in the case of a set of porcelain preparing for the King, the work was stopped in its progress for want of artists of sufficient skill. Now, I should think that was very likely to be the case, and yet I should be slow to deduce from it an inference to the prejudice of our native artists. Kings can never be numerous as customers, and no manufacturer would ever think of rearing up designers for the special purpose of supplying an occasional order from such a quarter.

Then do you lay down this principle, that it is in vain to offer to the great mass of consumers works which combine with perfect manufacture elegance of design, because they would not be appreciated by them?—I think, considering the existing state of taste among the great mass of consumers, you might produce patterns so elegant that they would not sell; for instance, in the negro markets of the West Indies and America, which take a large supply of goods from this country, the more gaudy an article is, the more of red and yellow in barbarous combination there is in it, the more likely it is to please.

Is not that an extreme case?—I hardly think so; our fabrics go over all the world. People of taste are fond of complaining of the many ugly patterns which our manufacturers are constantly sending forth, when *with the same trouble,* and at the same expense, so much finer patterns may be produced; but they would not do so, if they only considered how many ugly tastes our manufacturers have to cater for.

Do you apprehend that the ware of Wedgwood was indebted for any of the preference shown to it to the delicate design upon it?—No doubt the elegance of the design contributed to the circulation of the ware.

Has the Wedgwood ware been in general use?—In universal use.

Is not the design upon that ware a classic pattern from the antique, brought from the extremities of Italy?—Some of it is of that description, some not; but it is the general character of the ware.

Do not the designs which are most sought for by the great mass of consumers proceed from the excavations of Pompeii?—I doubt whether those are the designs most sought after; there is a pattern which was a long time in very general use for table services, called the "Willow Pattern;" there is nothing very classical in that.

Do you suppose that, if the ware be equally good, and the design more elegant, in course of years the consumption would be greater or not?—I have no doubt that such an increase of elegance in the productions of our potteries would help to improve public taste, and to produce an increased demand for articles of a higher cast.

Do you think that in the long run, that which is founded upon admitted principles of beauty, is more certain ultimately to prevail, than that which is founded merely upon the ephemeral taste of the day?—I have no doubt of it; but I think the public mind must be educated to distinguish what is beauty and what not.

Do not the artisans of this country form a great portion of the public of this country?—Yes.

Are not they consumers as well as producers of manufactures?—No doubt.

Do not they consume the articles produced by others, as well as manufacture themselves?—Yes.

Then if you educate the eye of the artisan of this country, would not you educate the eye of the public?—Yes; so far as the artisans make a part of the public; I do not mean to question that the artisans at large share in whatever degree of bad taste distinguishes the country, but I repeat that in my opinion they are rather before the rest of the community in this respect.

Do you know what proportion the artisans of the country bear to the whole population?—I cannot at present state the exact proportion; probably a fifth or sixth; but whatever the proportion may be, I apprehend it matters not. I know that an impression to the effect I have just stated does exist very extensively among our artisans themselves. Nothing is more common than to hear such of them as have any thing to do with the designing or planning of works, complain of the manner in which they are constantly thwarted by the bad taste of those who employ them. The tailors have got a phrase among them which describes this feeling very exactly; they call it "working to the head," or fancy, of the customer.

Are there any means of giving a proper turn to the head or fancy of the customer?—Many.

What means?—I would particularise, before all others, the circulation, as widely as possible, of good copies of the best existing works of art.

Do you suppose that the taste of the customers would be influenced materially by the circulation of good works of art?—Most materially; I consider that very much of the bad taste of the country has been owing to the circulation of wretched prints all over the country, and still more wretched stucco images; the country has been inundated by them for the last fifty years and more. I may observe, by the way, as not a little curious, that this inundation has not proceeded from native artists, but from Italians. It is from Italy itself, the favourite seat of the fine arts, that this flood of execrable taste has come in upon us.

Do you attribute the employment of Italian designers upon those inferior works to the circumstance that the demand of the purchasers originates from a low taste in art?—No doubt they consulted the taste of their customers.

Do you consider that the multiplication and circulation of copies of good models would have a great influence in refining public taste, and producing improvement in works of design?—An incalculable influence.

Do you consider that the progress of the arts in this country is impeded by the want of protection for new inventions of importance? — Very much impeded. Inventions connected with the arts of design, of new instruments, or new processes, for example, are, from the ease with which they can be pirated, more difficult of protection than any other inventions whatever. Such protection as the existing laws afford is quite inadequate. I cannot better illustrate my meaning, than by mentioning the case of engraving in metallic relief, an art which is supposed to have existed three or four centuries ago; and the re-discovery of which has been long a desideratum among artists. Albert Durer, who was both a painter and engraver, certainly possessed this art, that is to say, the art of transferring his designs after they had been sketched on paper, immediately into metallic relief, so that they might be printed along with letter-press. At present, the only sort of engravings you can print along with letter-press are wood-engravings, or stereotype casts from wood-engravings; and then those engravings are but copies, and often very rude copies, of their originals; while in the case of Albert Durer, it is quite clear that it was his own identical designs that were transferred into the metallic relief. Wood-engravings, too, are limited in point of size, because they can only be executed on box-wood, the width of which is very small; in fact, we have no wood-engravings on a single block of a larger size than octavo; when the engraving is larger, two or three blocks are joined together; but this is attended with so much difficulty and inconvenience, that it is seldom done. From the specimens of metallic relief engraving, left us by Albert Durer, there is every reason to infer that he was under no such limitation, that he could produce plates of any size. Now the importance of such an invention will be immediately seen, when it is considered that if you could produce an engraving of a work of art with as much facility as you can produce in types a copy of manuscript, and you could work this engraving along with the letter-press, you would have works of the largest size illustrated to a degree that is now unattainable, and might multiply copies of works of art with twenty times the celerity, and at more than twenty times less expense, than you can do now. No wonder, therefore, the re-discovery of this invention has been so long a desideratum. Many are the persons who have tried to accomplish it; and I know of more than one or two who may say they have succeeded. About the year 1824, a Mr. Foulis, well known as an eminent printer in Glasgow, communicated to me that he had made a re-discovery of this art; and he produced a letter from the late Mr. Roscoe, of Liverpool, upon the subject, in which that gentleman gave it as his opinion that the art had existed; and from what Mr. Foulis had stated to him, that he believed he was in possession of the secret. I introduced Mr. Foulis to two other gentlemen, for the purpose of bringing this art into use if possible. We joined together, and furnished funds for fitting up an establishment for the purpose; but after some time differences arose, and the thing dropped without being brought to a conclusion.

Was that in consequence of want of protection?—Principally so; there was a difficulty arose on that head. Mr. Foulis was between seventy and eighty years of age, and we were naturally very anxious that he would leave us some specification of the invention, that we might be able to work it out, to indemnify us for the expenses we were incurring. However, Mr. Foulis could not be prevailed with to give us a sufficient specification, and we never received it from him. He wished that we should take take out a patent for our mutual protection; but had a patent been taken out, that would have led of necessity to the publication of the specification; and it seemed to us that were it once published, the invention would be lost as a matter of property to all concerned. I may mention that the differences I have alluded to, led to an arbitration before Mr. Bolland, now Baron Bolland, in which arbitration the question was raised, whether such an art as I have described did really exist or had existed. A great deal of evidence was adduced on this point, and a number of artists examined, and the result was, to prove, beyond all dispute, that the art had existed, and had been lost.

Is Mr. Foulis alive?—I believe he is dead, and probably the secret, as far as he was concerned, died with him; but more recently, about eighteen months ago, an eminent engineer in town, who was aware of the interest I had taken in this subject, came and informed me that a friend of his had made the same discovery. To put this at once to the test, I gave him from a portfolio a small specimen of a paper pattern, and he pledged himself that his friend would, next morning, produce a fac-simile of it in relief. The next morning he actually brought it me, done in relief, and done admirably; it was a pattern of very great difficulty, and a copy of it could not have been executed with the hand within the time, nor executed half so well. I was perfectly satisfied from this, that the art so much sought after had been once more rediscovered. The gentleman, however, not being himself an artist, was desirous of disposing of this secret. It was suggested, as before, to take out a patent; but the answer to this was, that if patented, he must then specify the process, and it would be immediately pirated in every garret in London. It was impossible, in fact, that a patent could give him any protection at all. The case of Sir David Brewster's kaleidoscope furnishes an illustration exactly in point. He took out a patent for it; but it was so universally pirated that he could not protect it, and he made little, if any, profit from an article which, if it could have been adequately protected, might have yielded him a handsome fortune.

Have any suggestions occurred to you as to the best mode of protecting such inventions?—I do not know any mode by which a property in inventions of this description could be protected; what I would suggest is this, that there should be an annual *public grant for the reward of such useful inventions as the patent* law cannot protect. In the present instance, all that the party asked was the sum of 500*l.* for the communication of his important secret; and because there is nobody to give him this sum, he keeps the secret locked up in his breast, and very probably it may be lost again to the community.

You suppose that there exist no means of protecting, and that there only exist means of rewarding such inventors?—Yes.

Is your opinion against the possibility of protection generally in other inventions of art?—Against the possibility of protecting those inventions only which can be practised by such numbers of persons in obscure holes and corners, that to vindicate the property in them by legal process is impossible; you cannot prosecute a whole nation.

Cannot you prosecute one individual?—Yes; you may prosecute and put down one or two, but when every body infringes, and you have to prosecute every body, your right becomes practically a complete nullity. Where could be a stronger proof of this, than the case of Brewster's kaleidoscope, which I have just mentioned? although the undoubted inventor of it, he was powerless against a multitude. It may be said, that an inventor so circumstanced, can apply to the Society of Arts, but the premiums of that society are so small, and awarded by committees of so little select a description, that the authors of really valuable inventions do not often trouble it.

You would recommend, not a system of protection, but a system of reward?—In cases of the peculiar description I have mentioned, there are many cases where a patent will effectually protect.

Must not you bring proof that it is an original design before a reward is given?—I think there might be a commission of learned and intelligent persons appointed, before whom an inventor might go and submit his invention without much risk of his being able to deceive them as to its originality or ability. I would have this commission empowered to reward most liberally every new invention or improvement which they thought likely to be of national benefit; and that at once, in order that the author might have early enjoyment of the fruits of his ingenuity, and be left free to exercise his talents in the production of other inventions and improvements. They should, in fact, act on the same principle as the Society of Arts, but with larger means. Many useful inventions have been brought forward through the medium of the Society of Arts. I believe that steel engraving, which has done such wonders for the fine arts, was first introduced in consequence of one of their premiums; but I apprehend that were the entire number of inventions which have been rewarded by this society compared with the number carried into actual practice, the disproportion would be found enormous; and this I attribute principally to the smallness and inadequacy of their premiums.

Is not it a good guarantee for the ultimate success of an invention, that the artist appeals to the tribunal of the public for a decision upon the merits of it?—Yes, a very good guarantee for the success of the invention, but not a guarantee for the fruits of that success coming into the inventor's pocket. If an inventor can go into the market to supply the public demand, I think the public feeling is such that they will patronise him in preference to any pirate or interloper; but it is not every inventor who has the means of doing so, and there are many, such as amateur mechanics, who though they may have the means, have not the inclination.

Would not there be some danger in interposing an intermediate tribunal between the public and the inventor; would it not be leaving too much to their judgment, and rendering the inventor too independent of the final tribunal, which ought to decide upon it, namely, its merit in the eyes of the public?—I think the occasional loss to the public would be very small, and the advantage in a general view of the matter would be extremely great.

Have you ever turned your attention to the expediency of giving every advantage to our artists of seeing, without any expense, beautiful works of art?—I think they cannot be made too universally accessible.

Is there any want of natural design and taste in the artists of this country?—Not at all; I believe they are equal to any thing that they can be put to.

Has justice been done to them in allowing them a free inspection of works of art?—I do not think it has.

Is not it highly expedient that such exhibitions should be encouraged?—Highly expedient.

Have Mechanics' Institutions had a good effect in improving the taste of the artisans?—They must have had a good effect, but I should say not so good an effect as might have been expected, or such as they are calculated to produce under more judicious direction.

In what respect?—I think, generally speaking, there is a want of system in mechanics' institutions; there is no regular course of instruction followed in any of them. When a young man has attended for two or three years, the circumstance of his having so *attended suggests no definite idea of what he has learned during the time*, or what course of study he has gone through.

You would wish for more system in instruction and greater uniformity?—I should like some systematic course of instruction, suited to the wants of mechanics to be followed. The lectures given at these institutions often embrace subjects very foreign to the purposes of mechanics' institutions. All sorts of topics are discussed, and in every variety of order; there seems to be no principle of selection adhered to whatever.

Do you think it desirable that to a certain extent the nation should assist in the formation, or in the construction of edifices to be devoted to the instruction of artisans in the arts?—I should be very jealous of the interference of Government.

The question does not refer to interference, but simply assistance without interference?—I should hope more from the Government's undoing what it has done in the way of obstruction to the progress of the fine arts, than from any thing it can do to promote them.

(*To be continued.*)

NOTES AND NOTICES.

We think the sentence about which the dispute alluded to by Mr. Mark has arisen, is *not* "constructed consistently with the rules of grammar in reference to perspicuity."

We do not believe that an engine of the description respecting which O. H. F. makes inquiry is now any where at work.

Communications received from Iver M'Iver—Mr. Waldron—C. W.—S. B.—Henricus—Mr. Bergholt—V. H. H.

LIST OF NEW PATENTS, GRANTED BETWEEN THE 24TH OF OCTOBER, AND 22D OF NOVEMBER, 1835.

John Birkby, of High Town, near Leeds, card-maker, for improvements in machinery for pointing wire applicable for making of cards and pins. October 29; six months to specify.

John Springall, of Oulton, Suffolk, iron-founder, and Robert Ransome, of Ipswich, for an improved mode of manufacturing of certain parts of ploughs. November 2; six months to specify.

William Keene, of Bankside, Surrey, engineer, for improvements in machinery or apparatus for sowing corn, grain, and other seeds, and manuring land; being a communication from a foreigner residing abroad. November 2; six months to specify.

John Chanter, of Earl-street, London, and of Upper Stamford-street, Surrey, Esq., and John Gray, of Liverpool, engineer, for a new combination of parts forming an improved furnace for consuming smoke and economising fuel, applicable to locomotive carriages, steam-boats, and other useful purposes. November 2; six months to specify.

William Crofts, of Radford, Nottingham, machine-maker, for improvements in machinery for making bobbin-net lace; part of which improvements are for the purpose of making figured or ornamented bobbin-net lace. November 4; six months to specify.

John Whitehead, of Hereford Cottage, Old Brompton, Middlesex, chemist, for improvements in scouring and cleansing. November 5; six months to specify.

Thomas, Earl of Dundonald, of Regent's Park, for improvements in machinery and apparatus applicable to purposes of locomotion. November 5; six months to specify.

Henry Adcock, of Summerhill Terrace, Birmingham, engineer, for certain improvements at docks and quays to facilitate the importation and exportation of merchandise and abridge labour. November 5; six months to specify.

William Symington, of Bromley, Middlesex, cooper, for certain improvements in the machinery for propelling vessels by steam, parts of which are also applicable to motive machinery of other descriptions, whether actuated by steam or by any other moving power. November 7; six months to specify.

John Wilde, late of New York, now of Manchester, merchant, and Joseph Whitworth, of the latter place, engineer, for certain machinery for effecting the operation called knitting, and producing a fabric similar to that of knitted stockings; being partly a communication from a foreigner residing abroad. November 10; six months to specify.

Thomas Gregg, of Rose Bank, Bury, Lancaster, calico printer, for a mode of embossing and printing at one and the same time, by means of a cylinder or roller on goods or fabrics made of or from cotton, silk, flax, hemp, or wool, or any one or more of those materials, or on paper. November 10; six months to specify.

John Ericsson, of Albany-street, Regent's Park, civil engineer, for an instrument for ascertaining the depth of water in seas and rivers. November 14; six months to specify.

John William Fraser, of Ludgate Hill, for improvements in apparatus for descending under water. November 14; six months to specify.

Nicholas Troughton, of Broad-street, London, gentleman, for an improvement in finishing ornamental walls and other ornamental surfaces; being a communication from a foreigner residing abroad. November 14; six months to specify.

James Cropper, of Nottingham, lace manufacturer, and Thomas Brown Milnes, of Lenton Works, bleacher, for certain improvements in machinery or apparatus for embroidering or ornamenting bobbin-net, or lace, or cloths, stuff, or other fabrics, made from silk, cotton, wool, flax, or hemp; being a communication from a foreigner residing abroad. November 14; six months to specify.

John Joseph Charles Sheridan, of Walworth, Surrey, chemist, for certain improvements in the several processes of saccharine, vinous, and ascetous fermentations. November 17; six months to specify.

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LIST OF PATENTS FOR SCOTLAND SEALED, BETWEEN THE 22D OF OCTOBER AND THE 21ST OF NOVEMBER, 1835, INCLUSIVE.

William Wilkinson, of Lucas street, St. George-in-the-East, Middlesex, for a certain improvement or improvements in the mechanism or machinery by which steam-power is applied to give motion to ships, or other floating-vessels, in or through water. Sealed at Edinburgh, October 22, 1835.

Charles Pierre Devaux, of Fenchurch-street, London, merchant, for an invention, communicated to him by a person residing abroad, of certain improvements in smelting iron-stone and iron-ore. October 23.

William Lucy, of Birmingham, miller, for an improvement in steam-engines. October 23.

Joel Spiller, of Battersea, Surrey, engineer, for an improvement or improvements upon boilers for generating steam, or heating water or other fluids, for useful purposes. October 28.

Hugh Ford Bacon, of Christ College, Cambridge, gentleman, for an improved apparatus for regulating the flow of gas through pipes to gas-burners, with a view to uniformity of supply. October 28.

Samuel Slocum, of the New-road, St. Pancras, Middlesex, engineer, for improvements in machinery for making-pins. November 2.

Thomas Fleming Bergen, of Fair View Avenue, Dublin, civil engineer, for certain improvements in the method of suspending and adjusting the bodies of railway and other wheeled carriages. November 2.

William Longfield, of Otley, York, whitesmith, for an improved lock or fastening for doors, and other situations where security is required. November 4.

Robert Jupe, of New Bond-street, Middlesex, upholsterer, for certain improvements in expanding tables, and also in ornamental dessert, flower, and other stands. November 4.

Elijah Galloway, of Wellington-terrace, Waterloo-road, engineer, for certain improvements in paddle-wheels for propelling vessels. November 4.

William Patterson, of Dublin, gentleman, for an improvement in converting hides and skins into leather, by the application of matter obtained from a certain material not hitherto employed for that purpose. November 4.

George Edmund Donisthorpe, of Leicester, worsted-spinner, and Henry Rawson, of the same place, hosier, for certain improvements in the combing of wool and other fibrous substances. November 6.

John Birkley, of High-town, near Leeds, card-maker, for improvements in machinery for pointing wire applicable for making of cards and pins. November 13.

Richard Whiteside, of Ayr, wine-merchant, for certain improvements in the wheels of steam-carriages, and in the machinery for propelling the same, also applicable to other purposes. November 17.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price *6d.* Also, the volume complete, in boards, price *9s. 6d.*

☞ Patents taken out with economy and despatch; Specifications prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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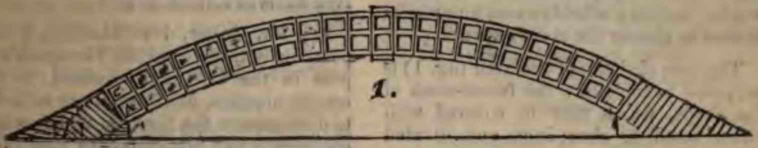
DESIGN FOR A FOOT-PASSENGER BRIDGE AND RIVER-ARCADE BETWEEN HUNGERFORD AND LAMBETH.



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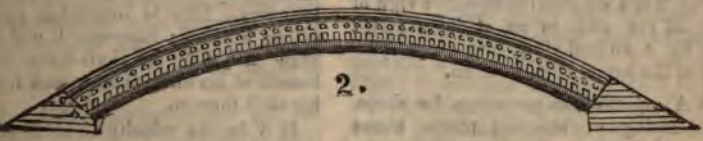

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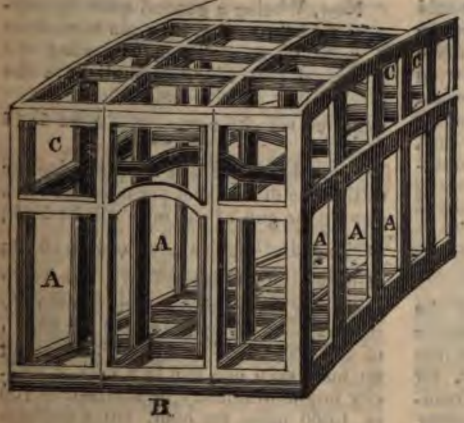
Fig. 3.



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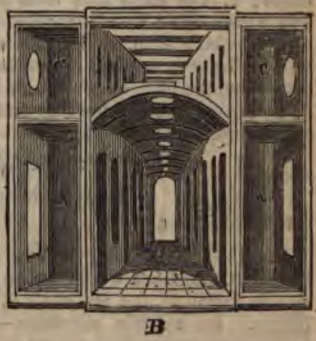

DESIGN FOR A FOOT-PASSENGER BRIDGE AND RIVER-ARCADE BETWEEN HUNGERFORD AND LAMBETH.

Sir,—Observing from the newspapers that a suspension-bridge for foot-passengers from Hungerford-market to Lambeth is in contemplation, perhaps you will allow me to submit the accompanying rough sketches of a mode of "killing two birds with one stone;" in other words, building a bridge and an arcade-bazaar at almost the same expense.

The iron skeleton of the arch (fig. 1) is supposed to constitute the frame-work of the shops, which may be covered with either wood or sheet-iron, and divided from each other by thin partitions.

Fig. 2 exhibits the appearance the arch would have in its complete state.

Fig. 3 is a diagonal perspective view of part of the arch in its skeleton state; and fig. 4, an end-view, also, in perspective of the same when finished.

A A are the compartments for shops, with eating or sleeping rooms above them, C C. B is the thoroughfare for foot-passengers.

A bridge of this description, for foot-passengers only, would not require any elevation above the mere arch; as a few broad steps at each end would render the ascent and descent sufficiently easy.

The advantages of such a plan would be, 1. The revenue to be derived from the shops; 2. The extra tolls from loungers and purchasers; rooms appropriated to cigar-smoking and refreshments would be peculiarly attractive, from the extensive view the bridge would afford; and, 3. an abridgment of the size and consequent expense of the piers.

I am, Sir, yours respectfully,

WILLIAM RANWELL.

Woolwich, Nov. 21, 1835.

P. S.—I have long entertained the idea that the above would be an eligible appropriation of the materials of an iron bridge. By a little alteration—as, for instance, by suspending a horizontal roadway therefrom—a passage-way for horses, vehicles, &c. might be added. I lately met with a description of a wooden bridge at Pennsylvania upon a principle so similar, that it convinces me (while it dissipates my fancied originality) there is no practical difficulty whatever in the way.

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IVER MACIVER *versus* MR. HERAPATH'S FORMULA.

> "*I am afraid Mr. Herapath's bed for some time to come will not be a bed of roses; but he has made it for himself, and must, therefore, try to repose himself upon it in the best way that he can.*"—IVER MACIVER'S *Attack*, p. 43.

So, Mr. Editor, Iver Maciver, who so pompously threatened Mr. Herapath's repose in the language prefixed to this communication, discovers, when called on to demonstrate the theorem which was to overturn what Mr. Herapath had done, and to confer on the world a splendid discovery in locomotion, that *he has* "*made a slip!*" and now puts forth another theorem by way of correcting his former blunders. This is somewhat odd, and rather unusual; however, I will not be hard with him, he shall have the full benefit of his amendment, and I will try his skill therein.

If V be the velocity in miles per hour with which a locomotive train starts or is set in motion, h the absolute fall in feet of any inclined plane, and $g = 32\frac{1}{6}$, then "the last-acquired velocity in miles per hour," says Iver Maciver, p. 124, "will be $\sqrt{V^2 + 2gh} \cdot \frac{15}{22}$."

Now, V being a general quantity, suppose it $= 0$; or that the train starts from a point of rest. Then, neglecting the fractional part of g, we shall have the acquired velocity $v = \frac{15}{22} 8\sqrt{h} = 5 \cdot 45 \sqrt{h}$ nearly. That is, if the plane decline at the rate of one foot per mile, the velocity at the end of one mile will be 5·45; at the end of 4 miles $5 \cdot 45 \sqrt{4} = 10 \cdot 9$; at the end of 9 miles $= 5{\cdot}45 \sqrt{9} = 16{\cdot}35$ miles per hour; and so on perpetually increasing as the square root of the length of the plane. So that in a plane falling no more than one foot in a mile, a velocity might ultimately be attained of 100 or 1,000 miles per hour, but a uniform velocity is, under any circumstances whatever, out of the question!! The absurdity does not even stop here. The theorem is unlimited as to load; and, therefore, it is immaterial whether the load be a pound or a 1,000 tons, whether the engine be capable of moving the load or not, and whether the boiler be heated by the most powerful fire or by only a farthing rush-light, the same velocity must in every instance be acquired in the same distance! Did ever Iver Maciver see a locomotive-engine, or converse with any one who had?

Setting out still from a point of rest, let us now turn the train up hill. In this case h, as every mathematician knows, becomes negative, and we have $v = 5{\cdot}45 \sqrt{-h}$ = an imaginary quantity. Therefore, if the plane rise only at the rate of an inch a mile, or an inch in 10,000 miles, the velocity will be imaginary. That is, the train will neither stand still, go forward, or backward; nor can any one tell which way it will go, except perhaps Iver Maciver, who may find it out by peeping a little further into "Nature's unerring laws," with which he seems to be so intimate.

Well, since this theorem will not answer up hill, or down hill, let us try what it will do on a level. It is too bad if it will not help poor Iver Maciver out here. In this case $h = 0$ and $v = \frac{15}{22}$ V; or the acquired velocity is the $\frac{15}{22}d$ part of the starting velocity, be it what it may. Supposing, therefore, the train by some means or other could be shoved forward with a velocity of 22 miles an hour, the engine would be able to keep up only 15; if with a velocity of 11, only 7½; and if it was at rest, *there* it must remain to eternity, however light the load and however powerful the engine!!! Oh! excellent Iver Maciver.

This is the theorem—aye, the amended theorem, too—which is to furnish the world with the principles of locomotion, "from," as Iver Maciver pompously declares, "Nature's unerring laws,"—a theorem producing results equally absurd up hill, down hill, or on a level. It is with this blundering abortion of impotence he presumes to test the labours of Mr. Herapath, and because they will not agree with it—how in the name of common sense can *they?*—*he dares to pronounce them wrong*, and threatens to make Mr. Herapath's "bed for some time to come not a bed of roses!"

I beg here to add, that strange mistakes have been made respecting Mr. Herapath's theorem in descending trains, whether intentional or not the parties can best tell. If any one will read the first paragraph of Mr. Herapath's 9th letter, vol. xxiii. p. 425, he will see that Mr. H.'s reasons for limiting the descending application to a fall of 6 feet per mile, are not from any defect in the theorem, but from considerations of safety.

ANTI-CARPER.

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PRINCIPLES OF LOCOMOTION.

Sir,—I find that my scientific opponent, Mr. Herapath, has announced in the "Notes and Notices" of your last Number, "that present avocations of a pressing nature oblige him to defer his reply to Iver M'Iver till next week, or perhaps a week longer."* I am very happy to find that Mr. Herapath is at last so condescending as to consider the old kilted Highlander worthy of his *personal* notice. This is far more manly, than to allow such foul-mouthed, barking curs as Anti-H. and Anti-Carper to defend him; the last of whom has done Mr. Herapath's new theory more injury than I have yet done it myself. Mr. Herapath will find (I state so from experience) that he has ventured into a very different arena (now that he has condescended to let his lights burn before the readers of the *Mechanics' Magazine*) than what he found himself in some years ago, when he held forth in the *Times* newspaper. There he met with no antagonist, and was allowed to thunder forth unopposed his mathematical and physical edicts, to the terror and astonishment of all the Fellows of the Royal Society.

As I find, Mr. Editor, that it will not be much out of my way, I beg leave, in the first place, to make a few observations on the article of "S. Y., an Engineer." He states, that he has calculated the velocity which a body will attain with an initial velocity of 30 miles per hour; and that at the end of one mile, the descents being 1 and 16 feet per mile, the velocities will be 35½ and 52 miles respectively; and this he has done from theorems given in Dr. Gregory's "Mathematics for Practical Men." I have ot by me a copy of that book to refer to, but supposing S. Y. to have made no mistake, then Dr. Gregory's theorem must be $V+\sqrt{2gh}\cdot\frac{15}{22}$, which theorem I demonstrated in my last article to be untrue. I am afraid S. Y. has made some blunder, for on turning to Dr. Gregory's article on the same subject, vol. ii. of the Woolwich Course, I find the two following theorems:—

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* The note here quoted was an Editorial one, and we thought we had Mr. Herapath's authority for it; but on referring, at his request, to his correspondence with us, we find that we had applied to Iver Maciver an allusion intended for quite a different party.—ED. M. M.

$$S=\frac{V^2-v^2}{2g\,\text{sin.}\,i}\text{ for the ascending plane;}$$

and $S=\frac{v^2-V^2}{2g\,\text{sin.}\,i}$ for the descending plane.

From this last theorem we obtain $v=\sqrt{V^2+2\,g\,S\,\text{sin.}\,i}=\sqrt{V^2+2\,g\,h}$, the same as in my last article.

When I wrote my last article, I had not read Dr. Lardner's correction of some part of his evidence on the Great Western Railway Bill. He states in his correction, vol. xxiv. p. 67, "We must add to the square of the velocity due to the descent down the plane from a state of rest the square of the initial velocity, &c." Dr. Lardner does not explain how we are to find the velocity due to the descent from a state of rest The question he alludes to is this:—The length of the Box-hill plane is 2½ miles, or 13,200 feet, the descent 1 in 107. Now, suppose a carriage or train to have acquired a velocity of 20 miles per hour on commencing the descent, the steam being then turned off, Dr. Lardner states, that the velocity at the foot of the plane will be 50 miles per hour. We shall see how this agrees with the theorem, $v=\sqrt{V^2+2\,g\,S\,\text{sin.}\,i}$. Dr. Lardner assumes a descent of 1 in 250 as a balance for friction. Now, suppose $250=a$, $107=b$, and let $\frac{1}{b}-\frac{1}{a}=\frac{1}{d}=\text{sin.}\ i$, then $h=S\ \text{sin.}\ i$. Then, by the above theorem, $v=\sqrt{\left(29\tfrac{1}{3}\right)^2+\frac{64\tfrac{1}{3}\times 13200}{187}}=73{\cdot}3$ feet velocity per second: hence $73{\cdot}3\times\frac{15}{22}=$ 50 miles velocity an hour, agreeing with Dr. Lardner's last statement.* And thus, Mr. Editor, I have got two Doctors to agree with me, or rather I agree with the two Doctors.

As I find this article is already of sufficient length, I must for a few days postpone the remarks which I promised to make in my last article.

Yours, &c.

Iver M'Iver.

Nov. 23, 1835.

PREMIUMS OFFERED BY THE ROYA CORNWALL POLYTECHNIC SOCIET FOR 1836.

[We are glad to understand that th competition for these useful premiums not confined to Cornwall, but open ingenious men of all parts of the kingdom.—Ed. M. M.]

A premium of ten guineas, by Sir Charles Lemon, Bart., and R. W. Fox, Esq., for the best series of practical experiments, tending to prove how the dangers attendant on the present mode of blasting rocks may be most effectually and economically guarded against.

Two premiums, the first of seven guineas, the second of three guineas, by G. S. Borlase, Esq., for the two best chemical or mechanical plans for ventilating mines, which can be applied to the Cornish mines with advantage.

A premium of ten guineas, by G. C. Fox, Esq., for the best essay on the various diseases incidental to miners, their causes, and the best practical means of remedying them. Any statistical information as to their longevity, compared with that of the other population of the county, will be deemed highly desirable.

A premium of ten pounds, by John Hearle Tremayne, Esq., for the best available method, or improvement on the plans already suggested, for facilitating the ascent and descent of miners, provided the judges shall consider it to possess sufficient merit to entitle it to such premium.

A premium of ten guineas, by E. W. W. Pendarves, Esq., for the best practical method of ascertaining the quantity of water raised by each lift of pumps in the mines of this county.

Two premiums, the first of seven guineas, the second of three guineas, by John Taylor, Esq., for the most complete and accurate accounts of the quantity of water supplied to the boilers, the number of bushels of coals consumed, and the duty performed by any engine, for a period of not less than six months in the ensuing year.

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* If I should be called upon to demonstrate some of the steps of the above calculation, I will willingly do so.

A premium of ten pounds, by the Rev. Canon Rogers, for the most economical, safe, and efficient plan for lighting mines, consistent with the health of the miner,—such plan to be accompanied by a statement of the present actual consumption of candles, and the cost per dozen lbs., at some of the principal Cornish mines.

INDIAN-INK.

Sir,—In the 611th Number of the *Mechanics' Magazine*, you notice a method of making Indian-ink by mixing lamp-black with jelly. I had been endeavouring to find a solvent for charcoal, and I found that, by mixing it with a little milk (the charcoal being ground to an impalpable powder) just enough to wet it, you could obtain Indian-ink. The same process may be employed with lamp-black. If the presence of milk be an objection, it is easily got quit of by adding a large quantity of water, then allowing the charcoal to precipitate, and afterwards pouring off the water; which operation may be repeated till all the milk is abstracted.

I am, &c.

HENRICUS.

AUSTEN'S STEAM-ENGINE.

We quoted in No. 641, from the *Falmouth Packet*, a brief notice of the extraordinary results of an experimental trial made at the Fowey Consols and Lanescot Mines, with a new steam-engine invented by a Mr. Austen. Since then we have been favoured by a correspondent at St. Austel with the following copy of the official Report on the subject, and also with some notes upon it, which are well deserving of attention.—ED. M. M.

Experimental Trial of Austen's Steam-Engine, of 80-inches Cylinder, at the Fowey Consols and Lanescot Mines, Oct. 22d and 23d, 1835.

This celebrated engine, from its extraordinary and unprecedented power and astonishing rate of duty, having caused several engineers and others to express doubts respecting the truth of the reports, as published by Mr. Lean, in his monthly lists—the engineers, Mr. William Petherick and Mr. William West, at the suggestion of some scientific gentlemen of the county, and with the sanction and authority of the adventurers of those mines, have subjected her to a public trial.

A public meeting for that purpose took place at the above mines, at noon, on Thursday, the 22d inst., when J. S. Enys, Esq., of Enys, was requested by the meeting to nominate competent persons, totally unconnected with the mines, as a Committee, for the purpose of conducting the examination, in conformity with the general usage on such occasions.

The following persons were then appointed for that purpose:—

Mr. SAMUEL LYLE,
Mr. THOMAS PETHERICK,
Mr. JOHN BUDGE,
Mr. JOHN BRAY,
Mr. WILLIAM REMFRY,
Mr. JAMES THOMAS,
Mr. JOSEPH MORCOM, Jun.

Who undertook the duty, and made the following Report:—

REPORT.

We, the undersigned, having been appointed a Committee to conduct the trial of Austen's Engine, make the following Report of our proceedings, and the result of the experiment.

Statement of Proceedings.

1st. The coal-sheds carefully examined and found to be quite empty.

2d. Twenty-eight bushels of coals measured in the presence of the Committee and others.

3d. A bushel of coals weighed, and found to be 94lbs.

4th. The coal-shed door immediately locked, the key kept by the Committee, and the door sealed.

5th. The Committee's Counter at starting registered 00,000,660, and Mr. Lean, the Reporter's counter, 02,187,480. The counters locked and sealed as soon as their state was ascertained, and the keys delivered to the Chairman of the Committee.

6th. Quantity of grease delivered for the consumption of the engine 12lbs., and oil 1 quart.

7th. State of the fires strictly examined.

8th. Water in the boilers found to be at the regular working gauge.

9th. Steam gauge at starting 36½.

10th. Stroke in the shaft 9 feet 3 inches.

The trial commenced on Thursday, at 28 minutes after 1 o'clock, P.M.

During the trial, which lasted 24 hours and 27 minutes, the steam-gauge fluctuated between 36½ and 45, showing a pressure of from 36½ to 45lbs. on every square inch of the boilers; and the length of stroke in the shaft ranged from 9 feet 3 inches to 9 feet 5 inches, but the duty has been calculated at the minimum of 9 feet 3 inches.

The exact quantity of coals consumed was twenty-four bushels.

On unlocking and unsealing the counters in the presence of every member of the Committee, their respective states were found to be as follow, viz.:—

Committee's counter registered	6,947
Mr. Lean, the Reporter's counter, registered	21,937,67

Showing that the engine made 6,287 strokes, which is found to be 429 strokes per minute.

The working of the lilly lift was suspended, in consequence of the prang of the bucket breaking, and this lift remained idle from 40 minutes past 7 o'clock in the evening, to 23 minutes past 10 o'clock at night, being 2 hours and 43 minutes, for which stoppage, 3 hours has been allowed in the calculation of duty.

The steam-gauge at the termination of the trial stood at 44, being 7½ more than at the beginning.

Calculation.

	fath.	ft.	inch.	lbs.
Tye, rose, and crown lifts	97	3 and	15 box	44,870,96
Lilly lift...........	20	3 and	10¼ box	4,405,34
Puppy lift..........	13	3 and	10½ box	2,901,06
				52,177,36
Deduct for lilly lift being idle ⅛ of the whole time of working..............				551,00
				51,626,36

Duty, 125,095,713 lbs. raised one foot high by a bushel of coals.

Four bushels of coals remained unconsumed at the conclusion of the experiment, making the whole consumption 24 bushels.

At the time the engine stopped, the fires were in equally as good, if not better, condition, than at the commencement of the investigation.

The water in the boilers was higher at the conclusion than at the commencement of the experiment.

(Signed) JOHN BUDGE, Chairman.
SAMUEL LYLE,
THOMAS PETHERICK,
JOHN BRAY,
JAMES THOMAS,
WILLIAM REMFRY,
JOSEPH MORCOM, Jun.

Pitmen appointed by the Committee for examining the Pump Work.

JOHN PASCOE, from Herland Mines.
MARK JAMES, from Tamar Consols.
SAMUEL SECOMB, from Holmbush Mines.
SAMUEL HENWOOD, from Holmbush Mines.
RICHARD BENNETT, from Valletort Consols.
THOMAS RODDA, from the Tavistock Mining Company.

Notes.

The Report of the Committee of Pitmen was to the effect, that all the lifts were solid.

During the stoppage of the lilly lift the water from the puppy lift ran to waste, and the tye, rose, and crown, were supplied with schammal water from different levels.

As a faster velocity than three strokes per minute was advantageous to the engine, the water had been allowed to accumulate in the mine, and also to keep the lifts solid; the lilly lift, therefore, was evidently a lifting pump. The greater quantity of the water is usually raised by plungers, on the out-door or return stroke.

The injection water was about 50° Fahr.; the water from the condensers between 80° and 90°.

The duty is made up in the mode introduced by James Watt, namely, by valuing the one-third savings of coal due to him under his patent right, which is still the fair proportional test of the *work performed by engines.*

All the engines in the county are employed in pumping work high expansively, from 4 to 10 times, using steam in the boilers from 25 to 50lbs. per square inch on the safety-valve, or 39¾ to 64¾ lbs. per square inch *pressure*. Previous to its entry into the condensers, it is reduced by expansion to 4 or 10lbs. under atmospheric pressure. The mean pressure on the piston often exceeds Bolton and Watt's practice, as the load on the piston from the weight of main rods, &c. (sometimes 270 fathoms), varies from 7 to 17½ lbs. per square inch.—See Lean's Report.

The load in the shaft of an 80 varies from 50,000lbs. to 108,000lbs.—See Trelawny's engine-wheel, Vor.

Annexed is an extract from one of the monthly Reports of Mr. Lean, alluded to in the introduction to the preceding Report:—

EXTRACT FROM LEAN'S MONTHLY REPORT FOR OCTOBER.

Mines.	Engine and Diameter of Cylinder.	Load in H.P. on the Piston	Load per Square Inch of the Piston.	Length of Stroke in the Cylinder.	No. of Lifts.	Depth.	Diameter of the Pump.	Time.	Consumption of Coal in Bushels.	No. of Strokes.	Length of the Stroke in the Pump.	Load in Pounds.	Pounds lifted 1 foot high per Bushel of Coal.	No. of Strokes per Minute.	Oct. 1835. — REMARKS and ENGINEERS' NAMES.
			lbs.	feet		fathoms.	inches.								
Fowey Consols.	Austen's Engine, 80 inches Single.	3,116	9·3	10·3	3 2	97·3 3·4	15 10½	Oct. 1 to Oct. 22.	454	87,640	0·25	52,177	93,168,124	2·9	Drawing perpendicularly Main Beam over the Cylinder, one balance-bob at the surface. W. Petherick, W. West.

CONSTRUCTION OF CHIMNEYS.

Sir,—Having been obliged by the insertion of my proposed plans for quickly putting out fires, &c. in No. 632, *Mechanics' Magazine*, I beg leave to hand you the plan I would recommend for building chimneys, combining the following advantages; viz. simplicity, good draft, great safety, and means of cleansing at any time in a few minutes by any person—the operation affecting the whole of the connecting flues at once; my grand object being to remedy effectually that great evil and national disgrace—the cleansing of chimneys by children.

I would carry up from the cellar or lowest apartment a straight, cylindrical chimney, 12 inches in diameter, to about a foot above the ridge of the house-top, upon which any ornamental cap might be placed. A bar of iron, an inch thick, should be placed across, on the top course of bricks with cement, and another to correspond 2 feet from the bottom. In the centre of each of these bars an iron grooved revolving-wheel, about 1½ inch thick by 4 inches diameter, should be fixed. A chain should be passed round these wheels, the ends being firmly united by a piece of iron, one-fourth of an inch thick and 4 inches square. To this iron plate fix the brush by two thumb-screws. The brush is made thus:—A circular piece of elm, 4 or 5 inches thick and 7 inches in diameter, is thickly armed on its circumference with strong bristles or whalebone, 3 inches long out of the wood. A hole is made in the centre of the brush 4 inches in diameter, the inner surface being lined with sheet-iron. Through this hole the double chain passes, the thumb-screws being firmly screwed to the brush. A proper handle being put on the lower wheel, will thus enable the whole length of the chimney to be cleansed effectually in a few minutes, by the brush passing upwards, and down again by reversing the motion of the handle. Three feet from the bottom of the chimney there should be a door, to remain open except when sweeping. The fire-places being all parallel with each other, should have an opening about 6 inches in diameter passing off to the chimney; and as this would never exceed 18 or 20 inches in length, it could when necessary be swept with a hand-brush. There would by this plan be a great saving of room; and there might be more if the chimney were built in the party-wall, which would be perfectly safe, and admit of two sets of fire-places, probably 8 or 10 in number; by this means there would only be a 9-inch projection into the room, with a solid mantel-piece over. If the chimney is by the side of the fire-place, there must be a corresponding thickness of brick-work on the other side for uniformity sake.

I at first contemplated further improvement, but cannot at present see the way clearly for arranging it. It is this:—I wished to make in the side of this blank part a capacious opening, 18 inches above the level, narrowing gradually and sloping to the bottom of the grate, with a well-fitted door to the upper orifice. My view then was, to put one or two bushels of coals into this place; but the difficulty is, the means of propelling it forward for supply to the bottom of the fire. The advantages of this part of the plan would be a supply for four or five days, thereby saving trouble in drawing-rooms, &c.; and also, that as the carburetted hydrogen formed at the bottom of the fire rises, it would be completely consumed, and, consequently, only a small quantity of smoke would pass to the chimney.

Your obedient servant,

G. L. Smart.

Enfield, Nov. 5, 1835.

AERIAL NAVIGATION BY BIRDS.

Sir,—Perceiving in your present volume allusion made by Mr. T. M. Mackintosh to the practicability of training up certain species of the winged tribe for the purpose of aerial navigation, I beg the favour of a corner in your Magazine to offer a few remarks upon the subject.

I perfectly agree with the writer that original projectors are too often thought visionary, and turned into ridicule, when they are induced to lay before the public whatever appears extraordinary and difficult of accomplishment.

It so happens, that the idea of using birds for aerial navigation is a very old and favourite one of mine; and I have only neglected endeavours to bring it into actual practice, through the want of leisure to accomplish a task, requiring, it is true, little ingenuity, but much persevering assiduity and patience.

From the supposition that an idea of the sort would only be laughed at, I have hitherto only ventured to mention it to a few friends, with my opinion, that perhaps all the ancient accounts of flying may not be so fabulous as we now suppose them. However, as your correspondent has boldly broken the ice upon the subject, he may be pleased to know that his idea is not entirely solitary, notwithstanding the little variation there may be in our notions upon it; for my ideas exceed his in what may be judged extravagance, believing that eagles possess collectively sufficient power to fly with a man even without the buoyant aid of a balloon; and nothing but the failure of an ably conducted, practical experiment, could satisfy my mind that they could not be trained up to accomplish it. The following, I think, would be all the mechanical skill required, unless experience directed other measures:—

To a kind of very light or open wicker-work I would attach about 30 eagles, in rows one above the other, and about 3 abreast, supposing them capable of flying with a weight of 180 lbs., at the rate of 6 lbs. each, being the supposed weight of the man, together with the car and wicker-work. The aeronaut should be so placed in his car in the interior of the wicker-work, as that the latter containing the lower tier of eagles should, upon a descent, take the ground first.

For the guidance of the machine many methods may be imagined, three of which I will mention. The best would be to train up an eagle as a leader, with a light rein to direct him; if that was impracticable, I should fix a piece of meat at the end of a long, light pole, fitted to the fore part of the car, and working upon an universal joint, with a short arm from the fulcrum for the aeronaut to alter the position of the meat in every direction, which the birds should be trained up to follow. If the above and every other plan failed to give the eagles a voluntary direction, I would then resort to a coercive one, by a long pole, working on an universal joint (or an equivalent action), projected abaft the car with fan-tails at its extremity, and at right angles with each other, horizontally and vertically, so as to direct the machine in every direction in the simplest and easiest manner.

To realise a desideratum of this nature it requires, first of all, a person of property, and who would devote his whole time to the pursuit; as the expense of purchasing and rearing up the eagles, together with able assistants, would be considerable. Then he should have for his principal manager in the business one of those patient and persevering characters who have been accustomed from their youth to teach poodle-dogs and monkeys a variety of astonishing feats and tricks. It is almost incredible what these animals may be taught to accomplish. I have seen at a theatre at Naples wonderful performances of the sort, such as a poodle-dog coachman driving a coach with a footman in livery, in which were two poodle ladies, and pulling up before a street-door, at which the footman knocked, then opened the carriage-door and handed the ladies out. The same dogs I saw gallop at the word of command round the stage upon any two of their hind and fore legs; their action when balancing themselves upon their two off or near legs was particularly striking and beautiful.

I mention the above to give an idea of the vast pains, and I fear cruelty, which must have been bestowed upon these sagacious animals, and to give me an opportunity of stating my opinion, that had similar pains been taken to train up eagles to fly *in a body*, it would have been accomplished to a much better purpose, and would have been a most lucrative speculation by its novelty and usefulness; indeed, my principal inducement for troubling you with this communication is the hope that some persevering projector will take up the affair in good earnest, to the successful accomplishment of it; and if so, to him be due all the praise.

As to the manner of training up the eagles, it appears to me only necessary when young to attach them to the wicker-work machine, which should be properly weighted, and never suffer them to fly singly, but collectively, with it; this might be managed in various ways, by placing their daily food on the top of a tower or hill, and habituating them to take their meals there; this method would enable the trainer to ascertain exactly the weight they could easily fly with, for although I have mentioned the quantity as 6 lbs. each bird, that is mere supposition, as experience alone can determine that point, together with the distance they would be able to fly with any given weight, and *their velocity*.

Could a desideratum of this sort be accomplished without the assistance of a balloon, it would be welcomed as a thing really useful and valuable. With a balloon it would be difficult, and often dangerous, to alight on a windy day; there would be at least the liability of damaging it, together with the trouble and expense of replenishing the gas which had escaped. It would also meet with so much resistance in the air, that it would probably take as many eagles or other birds to propel it with the same velocity as the other, so that instead of a gain, there would be an expensive incumbrance; whereas, by placing all dependence upon the eagles, descending or ascending, might be done with the greatest facility and safety, and thus a journey in the air might be performed with equal ease, though with considerably greater velocity than one by land or sea, but only with a very light weight.

I will not trouble you any more on a subject which may now appear in its childish state, as bordering on the ridiculous: I remain, however, Mr. Editor, in earnest,

Your obedient servant,

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SELECT COMMITTEE OF THE HOUSE OF COMMONS ON ARTS AND MANUFACTURES.

MINUTES OF EVIDENCE.

(Concluded from last Number, p. 191.)

Mr. Joseph Clinton Robertson, examined:

What obstructions do you refer to?—To the heavy tax on paper, for one thing. Drawing papers are exceedingly expensive to persons of small means, and inferior papers are often used in copper-plate printing, when but for the tax, which is in proportion to the weight, much finer papers would be used, papers better calculated to do justice to the engraving.

Would not the withdrawing of such obstructions by Government be in fact an assistance by Government?—It would amount to the same thing.

Instead of giving additional speed to the machine, you remove the load that obstructs its progress?—Exactly so; and I would recommend the removal of all duties upon the importation of foreign prints; and also, that the Government should do their best to induce foreign Governments to do so likewise by our works of art. The import duty into this country is small, I believe, but still it operates to a certain extent.

Would you think it desirable that any

national assistance should be given, as in the case of building the schools without the slightest interference on the part of the Government, but simply that where the local resident population had advanced a certain sum, the Government should assist in the completion of the design?—I should think it highly expedient that the Government should give such limited assistance for the establishment of buildings, and probably some allowance also to the professors.

You think that the interference of Government is a burden?—It is too apt to lead to jobbing, but benefactions simply can do no harm. Supposing the inhabitants of a place were to come forward with two-thirds, Government might with great propriety, and without the least risk of evil consequence, assist with the other third.

Supposing that by the residents in any given district an offer was made to contribute a certain considerable proportion towards the formation of a gallery of casts, or a public library, or a collection of works of art, open freely to all the public, you think it would be wise in the Government, without the slightest degree of interference, simply to assist in the completion of the design?—I should think it highly expedient and highly honourable in the Government to give every encouragement in that way, to promote by all possible means the establishment of museums and galleries, so that they leave the management of them to the people themselves.

Is not it probable that eventually the nation would be repaid for the passing liberality of the Government?—I am satisfied of it; the more the taste of the country is improved, the more our manufactures will be improved; and the country that has the best manufactures will of course command the greatest export trade in the long run.

Are there any fiscal impediments to the circulation of abundant copies of drawings about the country?—Nothing but the expense; the duty upon paper is heavy; there are duties too of various kinds which make provisions and wages higher than they need be, and there are duties upon the importation of foreign prints; I believe also that our prints are not admitted to the Continent as freely as they ought to be.

Does the Excise duty on paper materially obstruct the circulation of works of art among the people?—I should think it does; it enhances the price very much.

Do not you think that our machinery and our capital offer to us a new mode of circulating a knowledge of the principles of art among the people in the application of that machinery and that capital to embellished works?—I believe that if books could be more generally and abundantly embellished than they are, if the embellishments could be as readily furnished on a large as on a small scale, and particularly if designers and artists could give fac-similes of their own designs, that would raise the arts to a much higher standard than they have ever yet attained in this country; and all this I believe to be now within our reach; encouragement and protection alone are wanting. By such an art as that of Albert Durer's, the standard would infallibly be greatly raised. It would not only abridge the time, labour, and expense of production themselves, and cause works of art to circulate among the people to twenty times the present amount, if not more, but make the people familiar with works of a much higher character than they have ever been before accustomed to. By the present mode of printing engravings with the roller-press, you cannot produce above 400 copies a day, whereas you might produce 20,000 from a plate in metallic relief, with equal ease, and all excellent impressions; impressions, too, not from copies, as even the best of engravings are, but of the artist's own original designs. You cannot, by the finest engravings in intaglio, give by any means so just a representation of the works of a Raphael or Michael Angelo, as a copy of the works of Milton or Shakspeare, executed by the meanest printer, conveys of the genius of either of these great writers. An engraving, by a secondary artist, of a good painting, like an ordinary translation of a first-rate poem, is always sure to lack much of the beauty of the original.

Is there any thing else you wish to state to the Committee?—I would mention one instance, to show the great importance of multiplying copies of good designs, and making them as cheap and easily attainable as possible. An ingenious mechanic in Scotland, of the name of Hunter, has invented a machine, a stone-planing and stone-turning machine; he cuts vases out with it; he will cut a large vase out in one day, hollowed and every thing complete, which would take a man a week to produce by hand. He is now fitting up a turning-apparatus for the purpose of producing a large supply of vases next winter, and he wrote to me to get him copies of the vases at the British Museum and in other collections in town. I have accordingly made a collection, which I shall send down at considerable expense to him. I mention this as an illustration of the importance of having cheap copies of all our good works of art; for copies will find their way, as in this instance, where museums cannot.

When you say copies, do you mean casts or drawings?—Drawings would do very well for the purpose I have just mentioned; but casts would be much better.

William Wyon, Esq., Chief Engraver of the Royal Mint, examined:

I came originally from Birmingham; I have left Birmingham twenty years. The result of my observations on the manufactures at that time was decidedly that there was a want of proper and due encouragement to the arts, as related to manufactures in that town. My attention about ten years ago was particularly directed to that subject; and on the establishment of the Society of Arts in Birmingham, I expressed to one of the committee a strong desire, that instead of having a society simply for the encouragement of the higher departments of the arts, it would be also desirable to direct the attention of the society to that species of decorative design required in the manufactures of the town, principally referring to silversmiths, or plated and brass work, in which they are obliged to have continual recourse to the works of the French. For example, when one series of designs have run out of fashion, there is frequently a want of supply for another, and they are obliged again to have recourse to the French. Some few years ago I recollect that the style that prevailed about the time of Louis XIV. was very much in fashion. Now it is changed to the modern style of the French; but still it is French that they look to, rather than originating designs of their own. I attribute this use of French designs to the want of encouragement and protection given to the arts in Birmingham. It is almost invariable, that those that draw for the manufacturers are obliged, for want of proper and due encouragement, to go to other departments of the art—to painting and sculpture; they become, instead of good designers for ornamental work, second, or third, or fourth-rate artists in painting and sculpture. The principal defects are want of originality in correctness of outline and proportion. Correctness is a very important ingredient in the education of an artist for manufactures. The taste that I should like to see would be derived from studying nature and the works of the goldsmiths of the 15th century, and works of that class; I think it would greatly improve them, if they had an opportunity; but they are generally very poor, and have not the means of obtaining access to the works that I think would be advantageous to them. The slightest impediment thrown in the way of any person frequently prevents him from doing that which he would do if there were an exhibition gratuitously open to him. A very slight impediment existed in the admission of persons to the British Museum; it was simply that of signing the name upon the admission, and since that slight impediment was done away with the number of persons that have been to see the Museum has greatly increased. The plan which I proposed some years ago, when the Society of Arts was being established, was that there should be the kind of connexion formed which I have already mentioned, and that premiums should be given for the most successful designs for candelabra and for epergnes, and for that particular class that is most manufactured in Birmingham; if in addition to this there was a good library, containing works of an ornamental character, it would be very beneficial. I should create the means of producing that which I wish to be imitated by models to draw from, that is, casts from the most beautiful pieces of the antique, particularly casts from the works of the goldsmiths of the fifteenth century, which have not been sufficiently attended to; and by this means I see no reason why we should not have a Benvenuto, Cellini, or a Flaxman, who has done more for that branch of the art than any other person, by his Shield of Achilles, and other deisgns of a similar kind. I should have a school for instructing them in their particular branch of art. Instead of studying simply from casts of figures, although very essential, I should like to have them also study from those particular ornamental kinds of work in demand. I would let them have, first, a general education in design, and afterwards superadd the application of that particular knowledge of design to the particular manufacture, and the particular material upon which the artisan was to employ his labour. I think the people themselves require education in art in order properly to appreciate art, and at the present time the public are just as likely to encourage a very inferior pattern as any thing that is really beautiful, for want of a general dissemination of taste throughout the country. The supply of art would create a demand for art, and the demand for art would in its turn create a supply of art, and the morals of the country would be greatly improved by creating a new taste. In the state of art as applied to metals now, as contrasted with its state a few years ago, there is no great improvement. Chasing, which is a very important branch of the arts, is at quite as low an ebb as it was some years ago. There is no perceptible improvement within the last twenty years, and it frequently occurs that when good designs have been obtained, they have been injured by inferior execution; the demand for manufactured works in the precious metals have increased. The finest bronzes in existence are derived from the ancient Greeks; but the gold and silver works of Cellini and his time are eminently beautiful; there are also remarkably fine works from Germany and France about the 15th century; and also about the period of Louis XIV. In England I have seen very fair specimens about the time of Elizabeth and James I., the period of Charles the First and Second; there are many beautiful productions. The metal dies of Thomas Simon, in the time of Charles I. and the Commonwealth, had a very remarkable effect in encouraging the taste for art: the coins of Simon were very fine, and very superior to those of his foreign rivals the Roettiers. I think a very unfortunate thing in this country is the circumstance of there being no medallic establishment; we have no medals except those which emanate immediately from the enterprise of individuals, which are struck in haste and worked off without much consideration. It appears to me that if a series of medals were promoted by the Government, it would tend very greatly to the dissemination of taste throughout the country. The influence of the great circulation of the different medals struck by Buonaparte in relation to the interesting events of history, had a great deal to do with the creation of the love of art which is universally allowed to exist in France. A cheap and more extensive circulation of medals among the people might be made instrumental in creating both a love and a knowledge of art; and I have been very anxious that the copper coinage should become to a certain extent historical; I should like to have recorded upon the coinage the most remarkable events, and likewise any discoveries in science. The infinite variety of coins that issued from the mints of Greece and Rome, with the multitudinous designs on the reverses, and their very various character, must have been an important element in the creation of the taste of Greece and Rome. In the copper coinage the head of the monarch might be constantly preserved, and the reverse frequently changed to accommodate itself to the events of the time; but it might be attended with inconvenience to the public if the designs for the reverses of the gold and silver coinage were frequently changed, from the difficulty of identifying the legal coinage. I should keep the gold and silver to one type, that is a type that is well understood by the country at large, and reserve the variety of designs to the copper coinage. In the periods of antiquity a great variety is to be found in the silver coinage; but I apprehend that arose from a great many small states each coining their own money. There would be no difficulty in accommodating a great variety of design to a perfect identity of weight; the difficulty would be with regard to relief; we cannot imitate the ancients in relief, our mode of coinage would not allow it. The most beautiful coins of antiquity be reproduced or imitated in the present day in coins not for ordinary circulation; coins of twenty or thirty guineas in gold, or of ten or twenty shillings in silver, which should be made legal tenders, but which should only be used to a certain limit for the purposes of circulation; it is a matter which has occupied my mind very seriously of late to improve the coinage of the country by having a five-pound piece of this description. Proof impressions of the present coinage in fine gold and silver are sought for with great eagerness; collectors of late are much increased. I think a threepenny piece in silver would be very desirable. I think that the artists in this country are superior in most branches of the fine arts, in reference to designs for metals; Flaxman's Shield of Achilles is superior to any thing of the kind in existence; but artists of that eminence have been rarely employed by manufacturers, except in the instance of Rundell and Bridge, and a few others, who employed Flaxman and Bailey, Stodhard and Howard, and other artists of celebrity, some years ago. There is no want of native talent for art in this country; it only wants development. I attribute the fact of beautiful specimens having been so little copied in the general class of productions which have been executed in this country, to the want of access to them. It is a curious circumstance, that occurred to me two days ago. An artist from Birmingham applied to me, asking me to put him in the way of getting designs from the French works, and I was lamenting with him the difficulty he experienced. Being himself very poor, he had no means of purchasing the works, and he had no means of copying them. There is a great want of protection to the inventors of original designs in this country, and that the manufacturers have frequently complained of their works being pirated; that after having gone to a very great expense in the production of any article to suit the taste of the time, it had been pirated, and therefore it is not worth their while to employ the best artists for the purpose.

REMARKS ON THE CONSTRUCTION OF BOG-ROADS.

Sir,—There are some instances where vehicles are obliged to run in the same track or rut, either owing to the sloping sides of a road, its inequality, or to facilitate the journey of the horses on account of its being boggy.

In the first case, they run on the crown of the road, consequently in the same rut; and as the traffic increases, the rut becomes greater. The inequalities of a road are a great evil; and when the road is boggy as well, the sides are still more avoided, as the water in running over the sloping sides is absorbed in the yielding substance, and renders passage over them impossible. Ruts cease to exist if the roads are worn equally in every part; therefore, if the roads are perfectly level or nearly flat, every vehicle will take a separate track. The first thing to be considered in the construction of bog-roads, after the ground is well drained, is the making the surface perfectly level; and after that has been effected, if concrete, similar to what is used in securing the foundations of buildings, and mixed with broken stone, were thrown in, and exposed for a considerable time, it would be superior to any other method previously adopted. When hardened sufficiently for constant use and friction, time alone would soon prove whether it would not be more serviceable and efficacious than either the method of "laying branches of trees on the level of the strata," or "firm heathy sods." When such roads are situated near any place from whence lime may be obtained, or gravel could be had in abundance, additional facilities would be offered for effecting this method, which, as it becomes by exposure as firm as a rock, would certainly be found beneficial. The additional expense attending the construction of such a road, if the work is properly performed, would also be compensated by the permanent and substantial road which would be the result.

Yours, &c.
FREDERICK LUSH.

Charles-square, Hoxton, Nov. 20, 1835.

ENGLISH AND FOREIGN WORKMEN.

Sir,—In behalf of the workmen of England, I beg to offer my most sincere thanks for the very able and just remarks delivered before the "Select Committee of the House of Commons on Arts and Manufactures" by the Editor of the *Mechanics' Magazine*, in vindication of the capability and taste of British artists and mechanics to produce works of art and design of the most elaborate description, provided an adequate remuneration can be awarded for the labour and skill expended in their production. In support of this position, I will furnish a case from the silk trade, as the attention of the Committee seems to have been more particularly directed to this branch of manufacture; and, in my opinion, one case well-authenticated is worth a dozen general statements.

In the beginning of the year 1831, I was engaged by a house in London to fit up a large factory in the west of England with power-looms for the purpose of manufacturing silk goods. We had also the machinery for silk-throwsting; so that the whole process from the raw state until it is finally fit for the silk-mercer's shop was begun and finished upon the premises. I fitted up the machinery and afterwards conducted the business up to the close of 1834. In these power-looms we manufactured figured silks of the richest descriptions, which were sold in Regent-street as fancy French silks, "of the newest pattern just imported." Under this colour we have sold thousands of yards of British manufactured goods, to gratify the morbid taste of a whimsical female public, craving after foreign rarities. So much for the superiority of French patterns. Possibly some of these goods have been produced to prove how much we are behind the French in art and design!

Besides, we have artists from the city of Lyons now practising in England, and could have plenty more if they were really superior, or we could afford to pay them. Those who are at present amongst us are employed, but I am not aware of any pre-eminence which they possess, nor are they sought after in preference to native artists.

I have no doubt that the establishment of schools of design would have a tendency to improve the national taste in works of art; but whether this improvement in art would cause an extension of our commercial intercourse, is quite another question. The truth of the matter is, that in the race of commerce the British manufacturer carries weight; and all the assistance he requires, is to have his load lightened that he may have a fair chance with his competitors. In highly-wrought works of art the price of labour forms a large proportion of the value; and unless the Committee can suggest some means to equalise the value of labour in the manufacturing countries of Europe, it is to be feared that very little real benefit will accrue to the British manufacturer from their labours, at least so far as our foreign trade is to be regarded. It was this difference in the value of labour that impelled the house with which I was engaged to attempt the manufacturing of figured silks by the power-loom. It was a bold experiment, no doubt, and the expense was heavy in the first instance, but we ultimately succeeded; after which we found little difficulty in competing with the French manufacturer. In short, I would say, in the language of the evidence before alluded to, "I do not know any thing that our artists are not capable of producing."

In another part of the same evidence it is recommended, that in certain cases where a patent gives no real protection, a reward should be given to the inventor corresponding to the utility or value of his invention. The Committee appear averse to this mode of encouragement, and ask the following question:—"Is it not a good guarantee for the ultimate success of an invention, that the artist appeals to the tribunal of the public for a decision upon the merits of it?—Answer—Yes, a very good guarantee for the success of the invention, but not a guarantee for the fruits of that success coming into the inventor's pocket. If an inventor can go into the market to supply the public demand, I think the public feeling is such that they will patronise him in preference to a pirate or interloper; but it is not every inventor who has the means of doing so." The only remark that I would offer on this part of the evidence is to be found in the following statement:—Upwards of two years ago I was fortunate enough to discover a practicable mode of constructing and working a rotary steam-engine on the expansive principle. It is well known, that this would be a great desideratum in steam navigation and locomotive-engines generally. But not being able to "go into the market to supply the public demand," the invention is to me a dead letter. I have thrown away several minor improvements in machinery; but this I am determined to keep until I can see some likely mode of "the fruits of the invention reaching the inventor's pocket," which, under existing circumstances, appears to be a matter of considerable difficulty. The patent laws protect the *capitalist to a* certain extent, but the *poor inventor gets no* reward but the empty honour, and sometimes that is denied—a poor reward, indeed!

Yours respectfully,

Thomas Simmons Mackintosh.

THE GREENWICH RAILWAY.

Sir,—Your correspondent H. would be one of the most amusing wights I ever met with in my life, if it were not for the trouble of replying to his inventions. It is impossible to read his ludicrous efforts to fix some act of misrepresentation on Mr. Herapath, and the petulant vexation he displays at his utter want of success with a grave and an undisturbed countenance.

This individual accuses Mr. Herapath of misrepresentation. Now if Mr. H. is guilty of such conduct, let it be fairly shown. He has for twenty years and more stood before the world with an unimpeached character for veracity; and from his known care and caution his friends have the greatest confidence in his statements. But notwithstanding this, and notwithstanding the highly complimentary testimonies you have repeatedly given of your utter disbelief of Mr. Herapath's wish to mislead or misrepresent, grounded on your knowledge of him and his scientific career—yet if Mr. Herapath has descended to such unworthy conduct, let it be shown by facts, not by sweeping assertions.

If any one can, let him point out in the thirteen Letters on Railways, within a fortnight, the cases of intentional and prejudicial misrepresentation on the part of Mr. Herapath, with the proofs clearly and concisely written on the opposite side of the page. Within another fortnight I, if no one else does, will undertake to answer the charges, and I have no doubt I shall then be able to exhibit H. and his aspersions in their true colours; but we shall see.

Philo Anti-H.

EMBOSSING ON WOOD.

Sir,—I have been shown some very beautiful specimens of embossing upon veneer, principally floral and arabesque designs, upon rosewood, maple, mahogany, elm, and other hard woods. The relief is almost *alto*, and has quite the appearance of carving. I understand the invention is patented, but that the inventor, M. Caccia, an Italian, has been prevented from bringing it into extensive operation from the primarily expensive nature of the machinery, and the jealousy of cabinet-makers, who declare that it would supersede carving and inlaying, and so spoil their business. The process may be so varied that the relief will be brought out in different colours; it is also applicable to the embossing of cloths, kerseymeres, waistcoat-pieces, paper-hangings, and things of a like nature.

This is the first instance, as far as I know, in which designs have been impressed upon wood—embossing is common enough upon card, paper, calico, and such fabrics; and unless there be some improvement in the process, I do not know that the patent will hold good. Making the parts in relief come up of different colours, I believe to be new; and upon this possibly the patent rests.

Embossed hard fancy woods might be very extensively and very beautifully applied to the ornamenting of cabinets, work-boxes, &c., and to the panels of doors and wainscoting. Herewith I send you some specimens that, in the effect produced, you may judge for yourself.

I am, &c.

P. B. T.

November, 1835.

[The above-mentioned specimens may be seen at our office, by any party who may think the subject worthy attention. —Ed. M. M.]

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OBSERVATIONS ON THE TRIAL OF AUSTEN'S STEAM-ENGINE.

[After the official Report of the trial of Mr. Austen's engine, inserted in a preceding part of this Number, was in the hands of the printer, we received the following copy of a letter which Mr. James Sims, of Chacewater, lately addressed on the subject to the *Falmouth Packet*, with a request that if we inserted the one we should also insert the other. As the request is a very fair one we readily comply with it.—Ed. M. M.]

Sir,—The account given of a steam-engine in your paper of last week, and which is stated to be an extraordinary steam-engine, is, in the fullest sense of the word, extraordinary, *not only in the duty as recorded*, but also in the mode which was adopted for conducting a trial of that kind. I have no doubt that at least all practical engineers will agree with me, that it is perfectly absurd to think of making a fair trial of the duty of a steam-engine (working under similar circumstances as the engine in question), in the short time of 24 hours; and, on referring to the average duty performed by this engine for the last six months, and comparing it with the duty as recorded to have been performed during this trial, I consider that I am fully justified in making this remark. Duty as recorded at the trial 125,095,713 lifted one foot high by the consumption of one bushel of coal; average duty for the last six months 89,964,183;—balance in favour of 24 hours' trial 35,131,530. The effectual working of this engine for six months, as reported by Mr. Lean, gives 89,964,183, and which is the data that any practical man would refer to, in order to ascertain the duty performed.

I find by the monthly reports of steam-engines, that by comparing the average duty performed by this engine for six months, beginning with April last, and ending with September; and Borlase's engine at Wheal Vor, for six months, beginning with December, 1832, and ending with May, 1833, there is a difference in favour of Austen's engine of 4,816,182; Austen's engine having performed during that time 89,964,183, and Borlase's engine 85,148,001. Borlase's engine never having been subjected to a trial of 24 hours only, there has been no proof of what the duty would amount to for that time, but so far as my opinion goes in matters of this kind, and I have no doubt that I hold it in common with every engineer in this county, there is no reason on earth why the duty should not be in a like proportion, provided it was tried in the same way, and by the same committee; therefore, if Mr. Lean have given correct reports of these engines, (of which I hope there is no doubt), I am at a loss to know to which the greatest praise is due—viz. Messrs. Petherick and West, the engineers of Austen's engine, or Captain Richards, the engineer of Borlase's engine. Messrs. Petherick and West's engine shows the greatest number of millions—but when it is known that an improvement which would enable them to save one bushel of coal, would raise the duty to nearly what it is above Richards's engine, and taking into consideration the differences under which the two engines are working, (Richards's engine having 190 fathoms of pump-work and four balance-bobs to contend with, and Petherick and West's engine only 128 fathoms of pump-work and one balance-bob), it ceases to be a matter of surprise why Petherick and West's engine should for a fair average of duty performed for the last six months do 4,816,182, or a little more than 1-19 more duty than

Richards's engine in the same time. I beg to state, that there is what is termed an advantage which Richards's engine has over that of Petherick and West's in the number of strokes per minute, the average of Richards's engine for the six months I have quoted being 6,33 strokes per minute, and the other 316 strokes per minute; but even this is of little importance, as I find, on referring to different reports, a 50-inch engine working 19 strokes per minute, and performing 51,740,126 duty; and on the same report a 53-inch engine working 4,66 strokes per minute, and performing 49,405,880 duty; and in another report, which was for April last, a 70-inch engine working 2,3 strokes per minute, and performing 66,845,381; and a 70-inch engine working 854 strokes per minute, and performing 64,378,231, plainly showing that whether an engine works three strokes per minute, or six strokes per minute, the difference in duty is of little importance. Having thus far explained this matter in a manner which I hope will enable the country to be undeceived respecting this *wonderful* engine, I conclude by saying that I deem it unnecessary to point out any other engines which have not been much below this in duty, as this can easily be ascertained by a short perusal of the Monthly Reports.—I am, &c.

JAMES SIMS.

NOTES AND NOTICES.

Bell Rock Lighthouse.—During the heavy gales of the month of October, the sea, for this early period of the season, broke uncommonly high upon the lighthouse, the foundation of which is immersed to the depth of the full rise at every tide. The light-keepers in their monthly report (ascertained by the position of the perspective windows of the house) state, that the sea rushed up the walls to the height of from 60 to 70 feet, on the 5th and 6th; to 80 feet on the 11th and 12th; and to 70 feet on the 26th. On these occasions the green seas collapse the lower part of the building, when sprays, as white as snow, shoot up, and in their fall, as seen from the balcony, produce effects truly sublime. To the mariner, passing at a safe distance from the rock, the lighthouse and its inmates cannot fail to suggest reflections somewhat awful. But habit has so trained the light-keepers to this scene, that it excites no alarm, and in their monthly return they go on with a detail of having caught a number of the birds which in storms constantly flutter about the light, and sometimes break the plate-glass windows. On the 23d, an immense flock of marrets and other sea birds occupied several hours in passing the lighthouse in their flight from the northward in the direction of the Isle of May, in the Frith of Forth. So uncommonly numerous were they, that it is supposed they must have been turned by stress of weather in their migratory flight.—*Montrose Review.*

Honourable Tribute from Workmen to their Employer.—The numerous work-people employed at the Leysmill Pavement Quarries paid a well-merited compliment to their employer, W. F. Lindsay Carnegie, Esq., of Boysack, on Wednesday, the 11th instant, by presenting to him, at the dinner which he gave them on the close of the quarrying season, a very handsome silver snuff-box, with a suitable inscription, expressive of their high esteem and respect for his character, and of their gratitude for the benefits they derive from his exertions in promoting the prosperity of the district. There is engraved on the box an excellent representation of the patent stone-planing machine, as now used in the quarries—the recent invention of Mr. James Hunter, the superintendent,—a machine which has excited the admiration of every one who has seen it in operation, and which promises to make a new era in the stone trade. The box was presented by the superintendent, in a neat speech, in name of his fellow-servants connected with the works,—upwards of a hundred of whom were present on the occasion. Mr. Lindsay Carnegie delivered an eloquent address in reply, expressing the gratification it afforded him to find that his efforts were to have done good in the country, and explaining his views, and his intention to continue to act the same part which had drawn this flattering mark of approval from the people in his employment. He remained with the company a considerable part of the evening; and the sentiments of attachment and respect that were evinced towards him, and the good feeling and enjoyment that prevailed, gave striking proof that the higher classes in society lessen neither their dignity nor their comfort by proper condescension to their inferiors. What makes this demonstration on the part of the working-people the more remarkable, is the circumstance that Mr. Lindsay Carnegie is well known to be the strenuous advocate of machinery, and every improvement tending to facilitate trade and abridge labour. The leading part taken by him has been the chief cause that this county is likely soon to enjoy railway communications, with all their advantages. The ignorant and prejudiced believe such improvements to be inimical to the welfare of the labouring classes; but here we have a large body of these very labouring classes themselves tendering their tribute of gratitude to an individual who, as far as the sphere of his influence extends, is the unwearied promoter of such improvements,—and they do so because they see and feel the beneficial effects of his exertions. By means of machinery—particularly the patent stone-planing machine, which has been perfected under his auspices, and must rank among the really important inventions of the present day—he has been enabled to surmount every difficulty in working his quarries, and has succeeded in establishing a stone trade there which already gives permanent employment to upwards of a hundred men, where, under the old system, and without such machinery, there would not now have been employment for a single individual; the works must have been abandoned, and with them all the advantages which they afford to the neighbouring country, as well as the labourers employed.—*Montrose Review.*

Communications received from Mr. Smart—J. E. —B.—Mr. Waldron—G. P.—V. H. H.

Erratum.—P. 87, lines 37 and 38 from top, "west to east" *vice* "east to west."

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price 6*d*. Also, the volume complete, in boards, price 9*s*. 6*d*.

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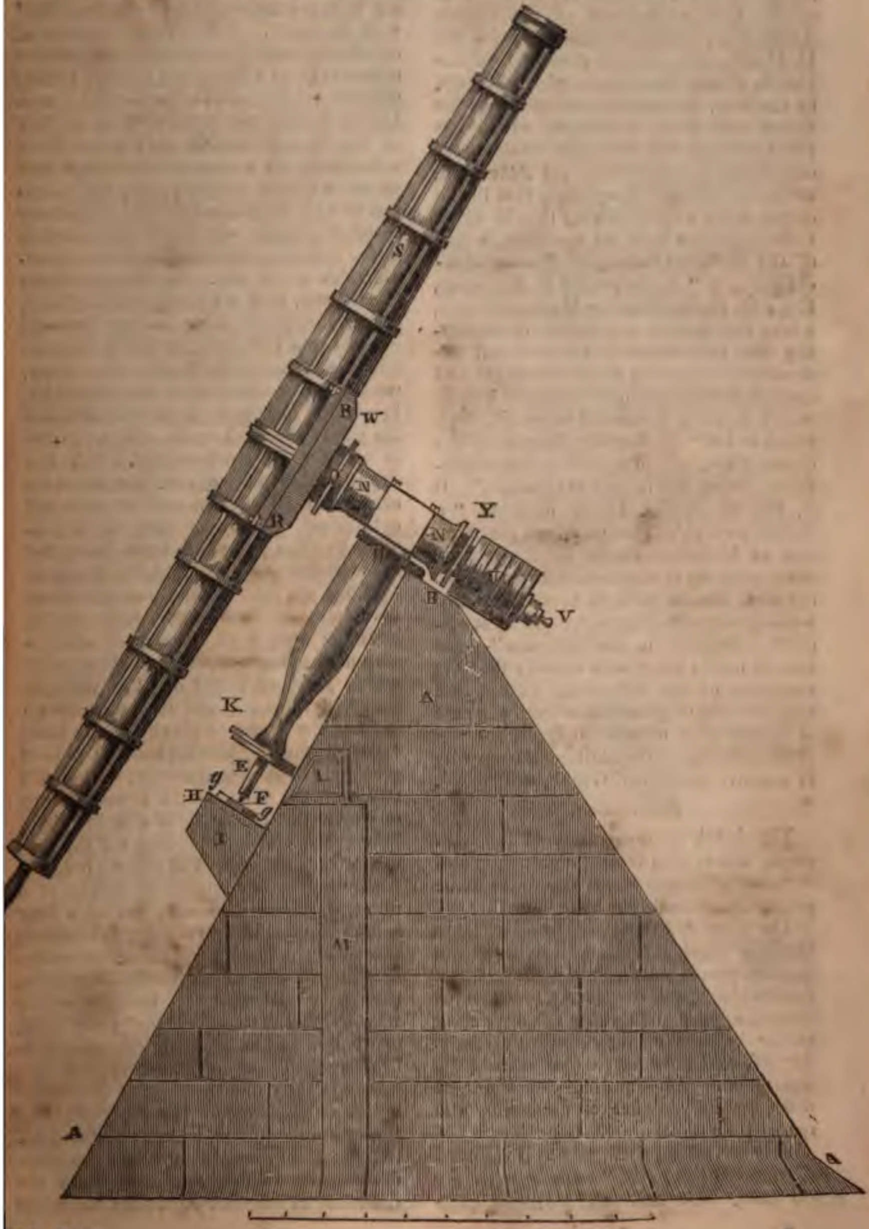
MR. COOPER'S GREAT ACHROMATIC TELESCOPE.



MR. COOPER'S GREAT ACHROMATIC TELESCOPE.

We extract the following description of this celebrated instrument from an Appendix to a Report of the Proceedings of the Dublin Meeting of the British Association, lately published by Mr. P. D. Hardy, the spirited conductor of the *Dublin Penny Magazine*—which Report, by the way, we would recommend as the fullest and most satisfactory which has yet appeared, the excellent abstracts of our worthy contemporary, the *Athenæum*, notwithstanding. It appears, that in the course of the week following that in which the Association held the meetings, a part of the Members interested in astronomical pursuits " accompanied E. J. Cooper, Esq., M. P. for Sligo, to Markree Castle, where they had an opportunity of inspecting the very superior astronomical instruments belonging to that distinguished and scientific individual"--foremost among which is his achromated telescope, supposed to be " the finest in the world—the object-glass, which is 13·3 inches in diameter, being the largest ever made." It is, indeed, as Mr. Hardy observes, " a matter well calculated to afford gratification to Irishmen, that a private gentleman, residing in a remote district of that country, should have, in a complete and well-appointed observatory, the most efficient telescope in the universe"—and also (it might have been added) that the mounting of the instrument (usually an achievement of great difficulty in the case of instruments of such magnitude) was accomplished by the skill and ingenuity of a native artist (Mr. Grubb, of Dublin).

Description.

The sketch is an elevation of the telescope, &c. as seen from the east side, and represents the instrument as pointed to the polar star, at six hours after transit.

The pier, A A A, is composed of large blocks of black marble, well jointed, and in some places cramped together, 4 feet thick at base, and decreasing to 3½ feet at top; the north and south sides are sloped to the latitude of the Observatory, viz. 54° 10′, and have steps (not seen in the figure), and also landing-places cut in them for convenience of ascending and reading the circles.

Two feet of the north side at B is sloped off, so as to form a right angle with the south side; into this part a strong cast-iron frame is fixed, carrying two cast-iron rollers, 12 inches diameter, with steel pivots, 1½ inch diameter, turning in very hard bell-metal bearings; they support the polar axis at its upper bearing, touching it in points, making an angle of 90° with its centre. D E is the polar axis, of cast-iron, turning between the friction-rollers at D, at which place it is 15¼ inches diameter, and its lower part ending in a hardened steel pivot, turning in a block of very hard bell-metal at F; this block is moveable by means of 4 screws *g*, and serves to adjust the polar axis; the box is screwed on the planed surface of a strong cast-iron plate H, which is firmly attached to the stone I, projecting out of the meridian side of the pier. K, the hour-circle of cast-iron, with a strong circle of brass, properly secured to it, having its edge ratched into 720 teeth, in which the endless-screw, connected with the clock, works, and graduated on the under side. L, a metal box, going from side to side of the pier in the clock-work. M, a channel in pier for the clock-weight. N N is a strong hollow piece of cast-iron, square in centre for 16 inches, and at each end cylindrical, with strong flanges; it is attached to the polar axis by 4 bolts, and carries friction-rollers, 7 inches diameter, working on steel pivots, one one-fourth diameter; on these rollers turns the declination axis, a small part of which is seen at Q; they support the axis at points which form an angle of 120° with the centre of the axis, and therefore always include the centre of gravity of the latter between them. The declination axis of cast-iron, 12 inches diameter, has, on the end next the telescope, a square flange, to which the cradle R is attached by 4 bolts; it is prevented sliding off the rollers (or in the direction of its own length), with very little friction, by means of a roller, 5½ inches diameter, having a long spindle fixed to it, and turning in bearings placed in the polar axis; this roller moves in a groove cut in the declination axis; the latter will on being inclined either way by the turning of the polar axis, cause one of the sides of the groove to bear against the roller, which, by partaking of any motion given to the declination axis, allows of the latter turning freely on its rollers without shifting laterally; the groove being about the hundredth part of an inch wider than the diameter of the roller, prevents the roller touching both sides of the groove at once. To the cradle R, of cast-iron, is attached the telescope tube S S, by two jointed wrought-iron straps. T, the tube, is of rolled iron, 24 inches diameter in centre, 16 inches at each end, of a panelled construction, weight 8 cwt. U is the counterpoise in 6 parts, of cast-iron; the interior of each part presents an annular ring divided into 6 parts by partitions, which are filled with lead, except a space of 1-6th of two of those parts, which, being left vacant, affords a simple means of bringing the centre of gravity of the declination axis, &c. into its centre of revolution. At V is a cylindrical sliding-weight, which, by being drawn in or out, adjusts the instrument for any difference in eye-pieces, &c. W is a ratched circle, fixed to the transverse part of the polar axis; an endless-screw attached to the cradle works in it, and turns the telescope in declination. Y is the declination circle, fixed on the declination axis, and led off by microscopes, attached to the upper part of the polar axis.

The entire, being polished, has been rust-bronzed, to resist the effects of damp. A force of 3lbs. applied to the eye-tube of the telescope, is sufficient to move the instrument in any direction. The weights are as follow:—

	cwt.	qr.	lbs.
The equatorial stand, including every part but telescope and counterpoise	23	3	21
Tube, object-glass, eye-tube, &c.	9	0	14
Counterpoise	12	1	19
	47	1	26

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ON THE APPLICATION OF THE HOT BLAST IN THE MANUFACTURE OF CAST-IRON. BY THOMAS CLARKE, M.D., PROFESSOR OF CHEMISTRY IN MARISCHALL COLLEGE, ABERDEEN.

(Read before the Royal Society of Edinburgh, March, 1835.)

Among persons interesting themselves in the progress of British manufactures, it can scarce fail to be known, that Mr. Neilson of Glasgow, manager of the Gas-Works in that city, has taken out a patent for an important improvement in the working of such furnaces as, in the language of the patent, "are supplied with air by means of bellows, or other blowing apparatus." In Scotland, Mr. Neilson's invention has been extensively applied to the making *of cast-iron, insomuch* that *there is only one Scotch iron-work* where the invention is not in use, and in that work, apparatus is under construction to put the invention into operation. Apart from the obvious importance of any considerable improvement in the manufacture of so valuable a product as cast-iron, the invention of Mr. Neilson would merit attention, were it only for the singular extent of the improvement effected, compared with the apparent simplicity—I had almost said inadequacy—of the means employed. Having therefore, by the liberality of Mr. Dunlop, proprietor of the Clyde Iron-Works, where Mr. Neilson's invention was first put into operation, obtained full and free access to all information regarding the results of trials of the invention in those works, on the large scale of manufacture, I cannot help thinking that an authentic notice of these results, together with an attempt to explain the cause of them, will prove acceptable to the Royal Society of Edinburgh. And that these results, as well as the cause of them, may be set forth with clearness, I shall advert,

1st. To the process of making iron, as formerly practised.

2d. To Mr. Neilson's alteration on that process.

3d. To the effect of that alteration.

4th. To the cause of that effect.

I. In proceeding to advert to the process of making cast-iron, as formerly practised, it cannot here be necessary to enter into much detail in explanation of a process, long practised and extensively known, as this has been; nor, indeed, shall I enter into detail, farther than, to the general scientific reader, may be proper to elucidate Mr. Neilson's invention.

In making cast-iron, then, the materials made use of were three,—

The ore,
The fuel,
The flux.

The ore was clay iron-stone, that is to say, carbonate of iron, mixed, in variable proportions, with carbonates of lime, and of magnesia, as well as with aluminous and siliceous matter.

The fuel made use of at Clyde Iron-Works, and in Scotland generally, was coke, derived from splint-coal. During its conversion into coke, this coal underwent a loss of 55 parts in the 100, leaving 45 of coke. The advantage of this previous conversion consisted in the higher temperature produced by the combustion of the coke, in consequence of none of the resulting heat disappearing in the latent form, in the vapours arising from the coal, during its conversion into coke.

The flux was common limestone, which was employed to act upon the aluminous and siliceous impurities of the ore, so as to produce a mixture more easy to melt than any of the materials of which it was made up, just as an alloy of tin and lead serves as a solder, the resulting alloy being more easy to melt than either the lead or the tin apart.

These three materials—the ore, the fuel, and the flux—were put into the furnace, near the top, in a state of mixture. The only other material supplied was air, which was driven into the furnace by pipes from blowing apparatus, and it entered the furnace by nozzles, sometimes on two opposite sides of the furnace, sometimes on three, and sometimes, but rarely, on four. The air supplied in this manner entered near the bottom of the furnace, at about 40 feet from the top, where the solid materials were put in. The furnace, in shape, consisted, at the middle part, of the frustums of two cones, having a horizontal base common to both, and the other and smaller ends of each prolonged into cylinders, which constituted the top and bottom of the furnace, as may be well enough conceived from the sectional sketch on the margin.

The whole of the materials put into the furnace, resolved themselves into gaseous products, and into liquid products. The gaseous products, escaping invisible at the top, included all the carbonaceous matter of the coke, probably in the form of carbonic acid, except only the small portion of carbon retained by the cast-iron. The liquid products were collected in the cylindrical reservoir, constituting the bottom of the furnace, and there divided themselves into two portions, the lower and heavier being the melted cast-iron, and the upper and lighter being the melted slag, resulting from the action of the fixed portion of the flux upon the fixed impurities of the fuel and of the ore.

II. Thus much being understood in regard to the process of making cast-iron, as formerly practised, we are now prepared for the statement of Mr. Neilson's improvement.

This improvement consists essentially in heating the air in its passage from the blowing apparatus to the furnace. The heating has hitherto been effected by making the air pass through cast-iron vessels, kept at a red heat. In the specification of the patent, Mr. Neilson states, that no particular form of heating-apparatus is essential to obtaining the beneficial effect of his invention; and, out of many forms that have been tried, experience does not seem to have yet decided which is best. At Clyde Iron-Works, the most beneficial of the results that I shall have occasion to state, were obtained by the obvious expedient of keeping red-hot the cast-iron cylindrical-pipes conveying the air from the blowing apparatus to the furnace.

III. Such being the simple nature of Mr. *Neilson's invention*, I now proceed to state *the effect of its application*.

During the first six months of the year 1829, when all the cast-iron in Clyde Iron-Works was made by means of the cold blast, a single ton of cast-iron required for fuel to reduce it, 8 tons 1¼ cwt. of coal, converted into coke. During the first six months of the following year, while the air was heated to near 300° Fahr., one ton of cast-iron required 5 tons 3¼ cwt. of coal, converted into coke.

The saving amounts to 2 tons 18 cwt. on the making of one ton of cast-iron; but from that saving comes to be deducted the coals used in heating the air, which were nearly 8 cwt. The nett saving thus was 2½ tons of coal on a single ton of cast-iron. But during that year, 1830, the air was heated no higher than 300° Fahr. The great success, however, of those trials, encouraged Mr. Dunlop, and other iron-masters, to try the effect of a still higher temperature. Nor were their expectations disappointed. The saving of coal was greatly increased, insomuch that, about the beginning of 1831, Mr. Dixon, proprietor of Calder Iron-Works, felt himself encouraged to attempt the substitution of raw coal for the coke before in use. Proceeding on the ascertained advantages of the hot blast, the attempt was entirely successful; and, since that period, the use of raw coal has extended so far as to be adopted in the majority of the Scotch iron-works. The temperature of the air under blast had now been raised so as to melt lead, and sometimes zinc, and therefore was above 600° Fahr., instead of being only 300°, as in the year 1830.

The furnace had now become so much elevated in temperature, as to require, around the nozzle of the blowpipes, a precaution borrowed from the finery-furnaces, wherein cast-iron is converted into malleable, but seldom or never employed where cast-iron is made by means of the cold blast. What is called the *Tweer*, is the opening in the furnace to admit the nozzle of the blowpipe. This opening is of a round funnel-shape, tapering inwards, and it used always to have a cast-iron lining, to protect the other building materials, and to afford them support. This cast-iron lining was just a tapering tube nearly of the shape of the blowpipe, but large enough to admit it freely. Now, under the changes I have been describing, the temperature of the furnace became so hot near the nozzles, as to risk the melting of the cast-iron lining, which, being essential to the *tweer*, is itself commonly called by that name. To prevent such an accident, an old invention called the *water-tweer* was made available. The peculiarity of this tweer consists in the cast-iron lining already described being cast hollow instead of solid, so as to contain water within, and water is kept there continually changing as it heats, by means of one pipe to admit the water cold, and another to let the water escape when heated.*

During the first six months of the year 1833, when all these changes had been fully brought into operation, one ton of cast-iron was made by means of 2 tons 5¼ cwt. of coal, which had not previously to be converted into coke. Adding to this 8 cwt. of coal for heating, we have 2 tons 13¼ cwt. of coal required to make a ton of iron; whereas, in 1829, when the cold blast was in operation, 8 tons 1¼ cwt. of coal had to be used. This being almost exactly three times as much, we have, from the change of the cold blast to the hot, combined with the use of coal instead of coke, *three times as much iron made from any given weight of splint coal.*

During the three successive periods that have been specified, the same blowing apparatus was in use; and not the least remarkable effect of Mr. Neilson's invention, has been the increased efficacy of a given quantity of air in the production of iron. The furnaces at Clyde Iron-Works, which were at first three, have been increased to four, and, the blast machinery being still the same, the following were the successive weekly products of iron during the periods already named, and the successive weekly consumpt of fuel put into the furnace, apart from what was used in heating the blast:—

	Tons.		Tons.		Tons.	
In 1829, from 3 furnaces,	111	Iron from	403	Coke, from	888	Coal.
In 1830, from 3 furnaces,	162	Iron from	376	Coke, from	836	Coal.
In 1833, from 4 furnaces,	245	Iron		from	554	Coal.

Comparing the product of 1829 with the product of 1833, it will be observed that the blast, in consequence of being heated, has reduced more than double the quantity of iron. The fuel consumed in these two periods we cannot compare, since, in the former, coke was burned, and, in the latter, coal. But on comparing the consumpt of coke in the years 1829 and 1830, we find that although the product of iron in the latter period was increased, yet the consumpt of coke was rather diminished. Hence the increased efficacy of the blast appears to be not greater than was to be expected, from the diminished fuel that had become necessary to smelt a given quantity of iron.

On the whole, then, the application of the hot blast has caused the same fuel to reduce three times as much iron as before, and the same blast twice as much as before.

The proportion of the flux required to reduce a given weight of the ore, has also been diminished. The amount of this diminution, and other particulars, interesting to practical persons, will appear on reference to a tabular statement supplied by Mr. Dunlop, and printed as an appendix to this paper. Not further to dwell on such details, I proceed to the last division of this paper, which is,

IV. To attempt an explanation of the foregoing extraordinary results.

Subsidiary to this attempt, it is necessary to discriminate between the quantity of fuel consumed and the temperature produced. For instance, we may conceive a stove to be kept at the temperature of 500° Fahr., and lead to be put into such a stove for the purpose of being melted. Then, since the melting point of lead is more than 100° higher, it is evident that whatever fuel might be consumed in keeping that stove at the temperature of 500°, the fuel is all consumed to no purpose, so far as regards the melting of lead, in consequence of deficiency in the temperature. In the manufacture of cast-iron likewise, experience has taught us, that a certain temperature is required in order to work the furnace favourably, and all the fuel consumed so as to produce any lower degree of temperature, is fuel consumed in vain. And how the hot blast serves to increase the temperature of a blast furnace, will appear on adverting to the relative weights of the solid and of the gaseous materials made use of in the reduction of iron.

As nearly as may be, a furnace, as wrought at Clyde Iron-Works in 1833, had two tons of solid materials an hour put in at the top, and this supply of two tons an hour was continued for 23 hours a-day, one half-hour every morning, and another every evening, being consumed in letting off the iron made. But the gaseous material—the hot air—what might be the weight of it? This can easily be ascertained thus: I find, by comparing the quantities of air consumed at Clyde Iron-Works, and at Calder Iron-Works, that one furnace requires of hot air from 2,500 to 3,000 cubical feet in a minute. I shall here assume 2,867 cubical feet to be the quantity; a number that I adopt for the sake of simplicity, inasmuch as, calculated at an avoirdupois ounce and a quarter, which is the weight of a cubical foot of air at 50° Fahr., these feet correspond precisely with 2 cwt. of air a minute, or *six tons an hour*. Two tons of solid material an hour, put in at the top of the furnace, can scarce hurtfully affect the temperature of the furnace, at least in the hottest part of it, which must be far down, and where the iron, besides being reduced to the state of metal, is melted, and the slag too produced. When the fuel put in at the top is coal, I have no doubt that, before it comes to this far-down part of the furnace—the place of its useful activity—the coal has been entirely coked; so that, in regard to the fuel, the new process differs from the old much more in appearance than in essence and reality. But if two tons of solid material an hour, put in at the top, are not likely to affect the temperature of the hottest part of the furnace, can we say the same of six tons of air an hour, forced in at the bottom near that hottest part? The air supplied is intended, no doubt, and answers to support the combustion; but this beneficial effect is, in the case of the cold blast, incidentally counteracted by the cooling power of six tons of air an hour, or two cwt. a minute, which, when forced in at the ordinary temperature of the air, cannot be conceived otherwise than as a prodigious refrigeratory passing through the hottest part of the furnace, and repressing its temperature. The expedient of previously heating the blast obviously removes this refrigeratory, leaving the air to act in promoting combustion, without robbing the combustion of any portion of the heat it produces.

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* An incidental advantage attended the adoption of the water-tweers, inasmuch as these made it practicable to lute up the space between the blow-pipe nozzle and the tweers, and thus prevent the loss of some air that formerly escaped by that space, and kept up a bellowing hiss, which, happily, is now no longer heard.

Such, I conceive, is the palpable, the adequate, and very simple explanation of the extraordinary advantages derived in the manufacture of cast-iron, from heating the air in its passage from the blowing apparatus to the furnace.

Marischal College, Aberdeen,
Jan. 10, 1835.

APPENDIX.

TABLE showing the Weight of Cast-Iron produced, and the Average Weight of Coals made use of, in producing a Ton of Cast-Iron, at Clyde Iron-Works, during the Years 1829, 1830, *and* 1833, *the Blowing-Engine being the same.*

COKE AND COLD AIR.							COKE AND HEATED AIR.							COAL AND HEATED AIR.						
1829	Weekly Product of Cast-Iron by Three Furnaces.			Average of Coals used to 1 Ton of Cast-Iron.			1830	Weekly Product of Cast-Iron by Three Furnaces.			Average of Coals used to 1 Ton of Cast-Iron.			1833	Weekly Product of Cast-Iron by Four Furnaces.			Average of Coals used to 1 Ton of Cast-Iron.		
	Tons	Cwt.	Qrs.	Tons	Cwt.	Qrs.		Tons	Cwt.	Qrs.	Tons	Cwt.	Qrs.		Tons	Cwt.	Qrs.	Tons	Cwt.	Qrs.
Jan. 7	137	18	2	8	12	1	Jan. 6	176	10	2	5	2	2	Jan. 9	375	8	0	2	12	3
14	148	2	0	6	9	2	13	181	12	2	5	0	2	16	267	18	0	2	4	0
21	148	8	2	6	11	3	20	172	5	2	5	0	2	23	270	7	2	2	3	1
28	138	9	2	7	0	2	27	178	7	0	4	19	0	30	250	9	0	2	4	0
Feb. 4	125	13	0	7	12	1	Feb. 3	164	8	0	5	4	0	Feb. 6	265	3	2	2	1	0
11	136	19	0	7	13	1	10	172	12	0	5	4	0	13	202	10	0	2	4	3
18	130	16	2	7	11	3	17	163	9	0	5	9	0	20	257	1	0	2	4	3
25	105	12	2	7	10	0	24	170	1	0	5	3	0	27	264	0	0	2	5	1
Mar. 4	101	8	1	7	17	2	Mar. 3	154	19	0	5	10	3	Mar. 6	234	13	0	2	5	2
11	111	2	0	8	2	2	10	154	16	0	5	9	2	13	238	7	2	2	7	1
18	114	10	0	7	6	2	17	151	8	2	5	9	3	20	205	13	0	2	10	2
25	110	14	0	8	8	1	24	163	17	0	5	5	1	27	217	14	0	2	2	3
Ap. 1	111	4	0	8	7	2	31	163	8	2	5	11	0	Ap. 3	220	7	0	2	14	2
8	107	7	0	8	3	0	Ap. 7	147	10	0	5	7	0	10	280	9	2	2	0	3
15	91	12	2	8	15	0	14	154	9	2	5	2	0	17	304	7	0	1	17	3
22	85	13	0	9	13	0	21	163	4	0	4	19	0	24	248	12	2	2	3	0
29	91	14	2	9	6	2	28	148	12	2	5	4	0	May 1	245	7	2	2	6	0
May 6	92	7	2	8	8	2	May 5	162	10	2	5	2	2	8	200	17	0	2	8	0
13	94	6	0	9	2	1	12	149	13	0	5	3	2	15	246	4	2	2	5	3
July 8	88	4	2	8	16	3	19	163	4	0	5	5	0	22	219	1	2	2	6	0
15	91	13	0	8	5	0	26	165	7	2	4	18	3	29	231	2	0	2	8	0
22	97	2	0	8	2	1	June 2	160	4	0	5	2	2	June 5	235	16	0	2	6	2
29	104	15	2	7	10	2	9	157	17	0	5	1	0	12	232	10	0	2	7	1
Aug. 5	106	17	2	7	5	2	16	164	0	0	4	17	3	19	271	1	2	2	1	0
12	93	1	0	8	6	0	23	149	3	0	4	18	0	26	262	3	2	2	3	1
19	113	7	0	8	18	2	30	162	16	2	4	16	3	½ w. 30	122	16	0	2	5	1
	2678	18	0	209	19	0		4215	6	0	134	6	2		6370	3	0	58	18	3
Average	110	14	2	8	1	1		162	2	2	5	3	1		245	0	0	2	5	1

The blowing-engine has a steam-cylinder of 40 inches diameter, and a blowing-cylinder of 8 feet deep and 80 inches diameter, *and goes 18 strokes a minute. The whole power of the engine was exerted in blowing* the three furnaces, as well as in blowing the four, and in both cases there were two tweers of 3 inches diameter to each furnace. The pressure of the blast was 2¼lb. to the square inch. The fourth furnace was put into operation after the water-tweers were introduced, and the open spaces round the blow-pipes were closed up by luting. The engine then went less than 18 strokes a minute, in consequence of the too great resistance of the materials contained in the three furnaces to the blast in its passage upwards.

Materials constituting a Charge.

		cwt.	qrs.	lbs.
1829,	Coke	5	0	0
	Roasted Ironstone	3	1	14
	Limestone	0	3	16
1830,	Coke	5	0	0
	Roasted Ironstone	5	0	0
	Limestone	1	1	16
1833,	Coal	5	0	0
	Roasted Ironstone	5	0	0
	Limestone	1	0	0

The correspondent by whom we have been obligingly favoured with the preceding paper, makes himself the following remarks on the subject of which it treats.—Ed. M. M.

"The best application of the hot blast that *I* have yet seen, is at the Wilsonton Iron-Works, near Lanark and Whitburn. At these works the heated air is never at a *lower* temperature than the melting point of lead (612°). This is readily *tested* by inserting a small bar of lead into an opening in the pipe for the purpose, a little way before it enters the furnace; the lead is *instantly* melted. When in good working order, zinc is fused (700°) in the same way. The air is heated in passing through a series of iron-pipes of *small* diameter, fixed upright in a brick oven, and kept at a red-heat; the heated air entering the furnace by *four tweers*. 'The Condie pipes,'—so called from Mr. John Condie, the manager of the Wilsonton Iron-Works, and late of the Calder—last much longer than the ill-arranged heating-apparatus (with pipes of large diameter) at the Clyde Iron-Works, and effect a much greater saving in fuel.

"The *raw coal* when used as the fuel, has the disadvantage of soon filling the furnace, and is also found to produce an inferior quality of iron, to that made by use of coke. It is, therefore, not unlikely to be soon, generally, given up."

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SELF-FEEDING AND SMOKE-CONSUMING FURNACES.

Sir,—I observed in your Magazine of the 21st of November, a sketch of a self-feeding and smoke-burning furnace, and, on reading the description, to my surprise I found it stated that a Mr. John Steel was the inventor. There never, sir, was a grosser piece of plagiarism. The feeder is mine; and the grate to which it is applied is Mr. Brunton's. In your No. 473, my plan is alluded to, in conjunction with my smoke-condenser; and Mr. Brunton's plan is also mentioned in one of your earlier Numbers. Mr. Brunton's plan was a revolving-grate, with a reciprocating-feeder; and mine was a reciprocating-grate, with a revolving-feeder. To remove all doubt on the subject, I subjoin an extract from the specification of my reciprocating-grate:—

"I next convey the coal, upon the aforesaid grate or fire-place, from a hopper fixed on the top or sides of the boiler, or other vessel intended to heat water or other fluids; from the bottom of this hopper is a pipe, which leads through the boiler. Or I make the boiler in separate apartments, and leave a space between them, and through this space or pipe the coal is conveyed upon the aforesaid moveable grate or fire-place, *by means of a wheel or roller, placed at the bottom of the hopper;* in the circumference of this roller are a number of grooves, recesses, or apertures, made *either in a line parallel to its axis, or in a spiral direction.* As this roller forms part of the bottom of the hopper, the grooves will be filled with part of the coal; and when the roller is turned round, it will regularly let the coal fall upon the grate, which, at the same time, is moving backward and forward, &c. &c."

I am, Sir,
Your obedient servant,
J. Dickson, Engineer.

9, Charlotte-street, Blackfriars-road,
Nov. 27, 1835.

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FREEING LEAKY VESSELS FROM WATER.

Sir,—In your valuable Magazine for the 21st of November, a correspondent, signing himself N. G., says, "that he has often thought the screw of Archimedes offered an easy means of freeing a leaky vessel of water; but he does not state how he would work the screw. Now, sir, it appears to me that the screw might be very well turned by the shaft of a circular windmill placed on deck; in which case, of course, the quantity of water worked out would depend on the force of the wind. The mill might be of moderate dimensions, constructed of materials light but strong, and so as to take to pieces, and be put together with little trouble, and in a short time. There need be no complicated machinery to create expense and cause confusion. I know not whether this plan has been suggested before, but I think it would answer. Nor am I skilful enough to decide whether an Archimedes' screw would be the best kind of engine to work by such a power; but a clever mechanic would soon form a judgment on th point.

I remain, Sir,
Your humble servant,
J. E.

ALLOYS, SOLDERS, AND AMALGAMS, USED IN THE ARTS.

(From the *Journal of the Franklin Institute.*)

The following table of the alloys and amalgams used in the arts, has been prepared Mr. Chaudet, a distinguished and experienced assayer in the Mint of Paris, from actu analysis of carefully selected samples. In a few instances, the proportions of the composi metals are not given, for reasons that, in one instance at least, are obvious. This deficien is more than compensated by the addition of several others, particularly that of the alloys Palladium, which I have added, in the full persuasion that the whole will be found useful.

Franklin Peale.

Alloy	Metal	Parts	Total
Alloy of Gold Coin.—(French Standard.)	Gold	900	1000
	Copper	100	
Alloy of Silver Coin.—(French Standard.)	Silver	900	1000
	Copper	100	
Alloy of "Billon."—(French Standard.)	Copper	800	1000
	Silver	200	
Alloy of Gold Medals.—(French Standard.)	Gold	916	1000
	Copper	84	
Alloy of Bronze Medals.*—	Copper	92	100
	Tin	8	
Alloy of Jewellery.—(French Standard.)	Gold	750	1000
	Copper	250	
Alloy of Silver Plate.†—(French Standard.)	Silver	950	1000
	Copper	50	
Alloy of Gold Coin.—(United States' Standard.)	Gold	899·22	1000
	Copper and Silver	100·78	
Alloy of Silver Coin.—(United States' Standard.)	Silver	892·43	1000
	Copper	107·57	
Alloy of Gold Coin.—(English Standard.)	Gold	916·67	1000
	Copper and Silver	83·33	
Alloy of Silver Coin.—(English Standard.)	Silver	925	1000
	Copper	75	
Alloy in imitation of Gold.—	Copper	91·00	100½
	Tin	9·50	
Alloy in imitation of Silver.‡—	Copper	61·27	106
	Zinc	28·78	
	Nickel	15·13	
	Lead	·82	

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* The medals made from this alloy are cast; they have the advantage of being struck by a few blow the press, and of wearing a long time.

The standard here indicated is the best; a second is composed of 800 of silver, and 200 of copper *the 1000.*

‡ *This alloy is the Packfond* of the Chinese.

Alloy for Cannon.*—	Copper	100	111
	Tin	11	
Alloy for Statues.†—	Copper	91·40	100
	Zinc	5·53	
	Tin	1·70	
	Lead	1·37	
Alloy for Bronzes and Candelabras.—	Copper	82·00	104½
	Zinc	18·00	
	Tin	3·00	
	Lead	1·50	
Alloy for the Mounting of Fire-arms.—	Copper	80	100
	Zinc	17	
	Tin	3	
Alloy for Cymbals,‡ Tam-Tams, or Chinese Gongs.—	Copper	80	100
	Tin	20	
Alloy for Bells.—	Copper	75	100
	Tin	25	
Alloy for the Reflectors of Telescopes.—	Copper	2	3
	Tin	1	
Alloy for Brass for the Lathe§.—	Copper	65·80	100
	Zinc	31·80	
	Lead	2·15	
	Tin	0·25	
Alloy of Brass for the Hammer.‖	Copper	70·10	100
	Zinc	29·90	
Alloy for Types.¶—	Lead	80	100
	Antimony	20	
Alloy fusible in Boiling Water.—	Bismuth	8	16
	Lead	5	
	Tin	3	
Alloy for Plugging Teeth.**—	Bismuth	8·	17·6
	Lead	5·	
	Tin	3·	
	Mercury	1·6	
Alloy for Tinning Iron.—	Tin	8	9
	Iron	1	
Alloy used to make Ductile Gold of 18 carats, or 950 milliemes.††—	Copper	990	1000
	Gold	10	

In this alloy small quantities of lead and zinc are often found, but they are present by accident.

The proportions here indicated are the result of an analysis of the beautiful bronze statues of the len of Versailles, which were cast by the Brothers Kellers, celebrated founders employed by is XIV.

This alloy is very hard; it is annealed by dipping, while red-hot, into water, and is then malleable; lst, if suffered to cool gradually, it is excessively hard: this important fact is due to M. d'Arcet, who thus furnished the means of fabricating, in France, cymbals, &c., formerly imported, at great cost, China.

The proportions here indicated having been found by analysis, it is evident that the tin is present by dent.

This alloy of brass is important, and is due to Mr. Chaudet.

Sometimes a small quantity *of copper* is added to these two metals.

This *alloy may be prepared with* a smaller proportion of mercury; it melts at 65° of the centigrade

The previous combination of the alloy is found to produce ductile gold, when the same metals woul *the contrary, if mixed directly.*

Alloy for Bells of Mantel Clocks.—	Copper	75	100
	Tin	25	
Alloy for the Pivots of Artificial Teeth.—	Platinum		
	Silver		
Alloy for ditto.[*]—	Palladium	50	100
	Silver	50	
Alloy for the Springs of Artificial Teeth.[†]—	Palladium	50	160
	Silver	50	
	Copper	50	
	Iron	10	
Solder for Gold of 750, or 18 carats.—	Gold of 750	2·00	3
	Copper	0·50	
	Silver	0·50	
Solder for Silver of 750.[‡]—	Silver	2	3
	Brass	1	
Solder for Brass.—	Copper	50	100
	Zinc	50	
Solder for Lead.—	Lead	2	3
	Tin	1	
Amalgam of Gold for Gilding on Metal.—	Mercury	91 to 89	100
	Gold	9 to 11	
Amalgam of Silver.—	Mercury	85	100
	Silver	15	
Amalgam for taking Impressions of Seals.[§]	Copper		
	Mercury		
Amalgam for Silvering Mirrors.—	Tin	70	100
	Mercury	30	
Amalgam for Silvering Globes of Glass.—	Mercury	80	100
	Bismuth	20	
Amalgam for the Cushions of Electrical Machines.—	Mercury	2	4
	Tin	1	
	Zinc	1	

Among the twenty-three metals that are not enumerated in the foregoing list, there are several that enter into alloys, but they are without utility in the arts; we should not, however, include in the remark, the native alloy of Osmiun and Rhodium, which is excessively hard, and is at present used for the nibs of metallic pens.

Care has been taken in the arrangement to name those metals first which enter in the largest quantities in the alloy.

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[*] This alloy is extremely important; it is used for all those purposes in the fabrication of philosophical instruments, for which platinum was formerly applied, being superior to it in hardness and colour, and yet inoxidable under all the usual circumstances.

[†] An extremely useful alloy, having a degree of elasticity only exceeded by steel, with all the advantages of superior lightness and hardness over platinum; this, and the preceding, are due to Mr. Percival N. Johnson, of London.

[‡] The copper and zinc ought to be taken in the form of brass; for two parts of silver, take one part of *brass.*

[§] *This amalgam is hard,* and melts at a low heat; it was used by the French police, under the *administration of the celebrated Fouché,* for the purpose of opening and resealing the letters that passed through *their hands.*

MR. HERAPATH'S LOCOMOTIVE THEOREMS.

Sir,—Mr. Herapath very kindly informs me, p. 22, No. 12 of his series, that if I will attentively read what he has written, I will find "that his theorems on railway transit are based on the principle that the opposing forces, namely, gravity and friction on the one side, and steam-power on the other one in equilibrio;" and, therefore, that this acceleration and retardation which, I "presume," have "no existence."

Now, in the first place, I beg leave to inform Mr. Herapath, that it is not my custom to *presume* to give an opinion upon any subject before having first considered it with attention; errors, no doubt, I have often fallen into, but never for the purpose of misleading. Nor do I wish to insinuate that Mr. H. has had any intention of misleading the readers of the *Mechanics' Magazine*. But from his vaunted attainments in mathematical and physical science, he seems to wish to convince us that he can at once jump to a conclusion which I, Iver M'Iver, a "*canny Scotchman*," will not implicitly believe before I have carefully examined the premises.

Secondly, with regard to the acceleration and retardation, which he says have "no existence," I would ask Mr. Herapath if he means to disown his own handiwork? Mr. H.'s theorems, for *determining* the speed on ascending and descending planes, are recorded in the *Mechanics' Magazine*, and no sophistry on my side, nor shuffling on his, can now alter them.

Again, Mr. Herapath informs me, "that his formulæ are not given as mathematically but practically true!" This, no doubt, is a singular concession; but I am almost sure, that had I been a practical man—a humble stoker, for example—and had urged similar objections to the prodigious velocity which his theorems produce, he would have found it convenient to reverse the above expression. Take it in either sense, however, I will ask him how he can reconcile such an expression with No. 2 of his series, in which we meet with the following memorable observations:—"Obloquy I know is frequently endeavoured to be thrown on scientific opinions by the ignorant and designing, from the vulgar prejudice that theory and practice are usually at variance. But I can assure my readers, that in no instance did I find experiments on the points I went last year to examine on the Liverpool and Manchester Railway, at the request of one of the Companies, differ sensibly from the results I had anticipated and computed previous to my going. *Theory, indeed,* as applied to any particular art, is *no more than experiment generalised*, and cannot, therefore, when managed with honesty and skill, materially differ from practice."

If I chose to adopt the language which Anti-H. has used towards the strong-of-hand H., or which Anti-Carper has used against myself, I could retort upon all three * with a vengeance, but for the present I shall forbear. I would just ask Mr. H. what proof has he given that his theorems are *practically* true? I may venture, I think, without much fear of contradiction, to answer the question myself—none whatever. They have never yet, by his own admission, been tested by any experiments. "There are," he states, "matters to be investigated to render the subject complete, and which, had not various causes interposed (the old story), I should before now have taken up, I admit," &c.

Mr. H. has very little cause to complain of want of time. The first number of his series appeared in the *Mechanics' Magazine* on May 30th, and week after week he was allowed to go on without any interference at a galloping pace, until he had absolutely attained a velocity (down a gentle descent) of 1,320 miles an hour, and by a little slight-of-hand-trick, he has shown us how a *greater* velocity may be attained by moving up an ascent!!! But, Mr. Editor, I am afraid Mr. H. has done himself great injustice, by denying that his theorems were not intended to be mathematically true. On this subject, however, I shall not at present enter, but reserve it for my next communication.

I am, Sir, yours, &c.,

IVER M'IVER.

Nov. 30, 1835.

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* The strong-of-hand Mr. "H." supposes that Mr. Herapath and Anti-H. are the same person;—might I ask him who he supposes Anti-Carper to be?

THE PRINCIPLES OF LOCOMOTION.

Sir,—In p. 124, Iver M'Iver supposes the "force of steam applied so as to overcome friction;" and as the resistance of the atmosphere has not, to the best of my recollection, been noticed in the observations of any of the parties, I thought the retarding forces were left out of consideration, in which case he will find the numbers I have given as correct as they were stated to be.

But Anti-Carper, in his last letter, blames Iver M'Iver for not taking the magnitude of the load, the power of the engine, and the mode of heating the boiler, into consideration; from which I think it is fair to infer, that the results derived from the rival theorems of Mr. Herapath are intended, in some way or other, to depend upon those matters; will Anti-Carper point out any of that gentleman's theorems in which they are introduced?

Yours, &c.

S. Y.

Dec. 7, 1835.

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NAVIGATION OF THE TYNE.

Sir,—I was lately in company with some persons who were talking on the subject of Jarrow Slake, as to its capabilities, &c.; and I stated that if it were cut off or filled in, it would materially improve the navigation of the River Tyne between Shields and Newcastle, but the others strongly dissented from my opinion. That it is the intention of Nature to do what I proposed, seems to me to be clearly proved by the increasing fluvial deposit. It might instruct others, however, as well as myself, if your able correspondents were to discuss the question in a cool way, and still more if they were to elucidate it by experiment, of which it is very capable. It is impossible to dam out the ocean; hence the water let into Jarrow Slake would, if prevented, be carried above Tyne Bridge, and add to the volume and current of the ebb-tide. I attempted to illustrate my argument by the fact of confining the spread of streams by quays, adding ta the depth of the water abreast of the quays; but this was also overborne by my opponents. I admit that the danger of crossing the bar at the last of the ebb would be much increased for a time; but this evil would be cancelled by a greater mean depth at high-water at neap-tides.

In 1825, I saw that something similar had been done in the Clyde; and I should think other rivers have had the same operation, that is, cutting off the waste-water and making docks, timber-ponds, or mill-reservoirs.

At this time when railroads are talking of between Newcastle and Shields, it would be as well to consider whether a road could be made across the Slake, saving much distance to South Shields from Gateshead. I have long had a plan for such works as sea-walls, built without cement or lime; which might be of service, and is quite original, having been thought of previous to the metallic caissons noticed in the *Mechanics' Magazine* some years since.

That there are great vested interests at stake upon this question is not to be doubted; yet if the good of many be advanced at the doubtful risk of the few, the merits of the question need not be advocated by your constant reader,

Keenams.

Durham, Nov. 27, 1835.

[We would recommend to the notice of our correspondent, and other friends on the Tyne, a very judicious article on regulating the flow of currents, in our 18th vol. p. 227.—Ed. M. M.]

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SLATE RAILWAY PLATFORMS—COAL-TAR A PRESERVATIVE OF STONE—ORGANIC ACTION.

Sir,—The letter which you did me the honour to insert in your No. 642, in observation on Mr. Jopling's plan of laying a complete platform of slate, instead of isolated blocks or sleepers, as a support to the rails of railroads, was written on the spur of the moment, and, as I now think, without having sufficiently reflected on the subject. My opinion now is, that instead of the slate itself being tapped with a female thread, it would be preferable, with respect to time, expense, and efficiency, to drill a plain hole in the slate, and insert a square nut into its under surface for the screwed end of the bolt. If the difference between the cost of copper or brass nuts and iron ones should be thought at all worthy of consideration, I beg leave to suggest, that iron ones will answer equally well. But to this intent the nuts must be imbedded, as it were, in coal-tar, and the bolts well covered with it, previously to their insertion. Both the bolts and nuts should be made hot, so as to dissipate all humidity from off their surface, at the time of dipping them into the tar. I suppose that the bolts will be about seven-eighths, and the nuts about three inches square.

A thread tapped in the slate in the way I speak of, in No. 642, would stand any other kind of force than that to which it will be subjected in the rail-holding case, perfectly well; but the hardest substances which, like all kind of stones, are brittle and friable, are not calculated to resist the sort of shocks and jars from the passing trains, in such parts as the threads of a screw. With metal nuts, the bolt need not be screwed further than a couple of inches, whereas, according to the other plan, much more would be required.

While on this subject, I should like some of your readers to see the hardening and strengthening effects of coal-tar applied to tiles and bricks for coping. They would be much pleased with the result. A composition of coal-tar and sifted road-scrapings forms a substance for coping walls, or other analogous purposes, more impermeable and imperishable than any stone. A little dry lime added to it, is an improvement. As I have explained in the *Mechanics' Magazine* ten years ago, linseed, or even whale oil, applied to the soft and perishable Portland stone, and even to the soft Bath sandstone, when quite dry, gives it the hardness and durability of marble. Coal-tar has the same effect; the only objection to it is the colour. But that may be remedied by subsequent whitewashing. Even marble exposed to the air in this country, ought to be protected in the way I have been advising these ten years past.

A union takes place between gelatinous and oleaginous fluids, and various earths and stones, which can only be compared to the process of fosilization in the very hard agatized parts which we find imbedded in stones *comparatively* soft; such as the oysters and amonites in limestone, the fossil fish in coal and other deposits, and the flints in chalk, all evidently caused by a combination of the animal juices with the earths *surrounding them. Thus I look* upon chalk formations, with their regular layers of flints, to have been successive deposits of lime in mechanical suspension in water upon a body of *moluscæ*, laying on the thin surface, or which sank down to it from out the fluid mass of chalk (lime), the latter itself, probably, the detritus of shells. Water is actually *solidified* in its union with lime, so are the substances I have been speaking of, and with other earths and oxides besides. After many years' attentive observation of nature, I have come to suspect, that the *modii* of matter we call metals, originate in what we term "organic" action. For example, in the *Mechanics' Magazine*, in Nov. 1828, it will be seen that I attribute the main part in the production of iron to the vegetative operations of forests, the green colour of the leaves being caused by the presence of iron, as is also the brown assumed by the same leaf at a later period.

I have the honour to be, Sir,

Your obedient humble servant,

F. Maceroni.

Dec. 6, 1835.

THE GREENWICH RAILWAY.

Sir,—Now that the Greenwich Railway has become rather a popular topic of conversation, I am beginning to get heartily sick of the exclamations which one hears constantly repeated in their ears, of "What a clever, what an *original* idea, that of carrying the rail over continuous arches, and converting those otherwise useless 'bins' into profitable shops, warehouses, private dwellings, &c.!!!" No one has a legitimate right to complain of any engineer for *adopting* a good idea, whenever suggested; but I cannot, I confess, either respect or admire the candour or ingenuousness of that projector who *silently* takes credit for what really does not belong to him. Does Colonel Landmann, in fact, claim the exclusive authorship, except by adaptation, of this plan? Can he deny having seen, heard, or read of his model elsewhere? And will he now at once frankly and honestly acknowledge *where* he found it? Because, sir, if he do not, and promptly, I shall inform him.

In the meanwhile, Mr. Editor, it may amuse your readers to "guess." To my knowledge, the idea of carrying a public thoroughfare or promenade over arches, &c., did not originate in *America*, Asia, Africa, or the British dominions; neither in France nor Belgium, Holland or Switzerland; no State in Germany or Italy; neither Spain or Portugal can claim the honour. Finally, Sweden, Denmark, and Norway, Russia, Prussia, Austria, Poland, Turkey, together with *all* the islands, foreign and domestic, are alike innocent of the "prodigious" thought now about to generate steam from London to Greenwich. The question, then, is, "Do you give it up, sir?" Till then, or the solution of my riddle by some of your numerous, and ingenious, and really ingenuous correspondents,

I beg to remain,
Your obedient servant,
P. S. H.

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RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal* for October, 1835.)

Casting Chilled Rollers, and other Metallic Cylinders and Cones, *James Harley, Pittsburg, Pennsylvania.*—"In order to show the object of my improvement," says the patentee, "I state the usual method as now practised in casting chilled rollers, as follows. The mould in which they are cast consists of a main central portion, formed by a hollow metallic cylinder, and the two ends, called journals and couplings, which are moulded in sand.

"Now, if the metal be poured into such a mould in the usual manner, that is, through a tube descending to its lower extremity, the motion thus communicated to it, as it rises in the mould, tends to throw all the sand, dross, slag, &c. towards the external part of the roller, and thereby occasions cracks, flaws, and other imperfections on its surface; therefore, in order to obviate this injurious tendency, it is the custom to stir the fluid metal with a rod, so as to give it a rotary motion, in order, by this stirring, to bring the light substances to the centre. But this operation of stirring is dangerous, and does not effect its object with certainty.

"My method of construction is, to insert a pipe or pipes (which may be called gates) at openings into or near the bottom of the main chill cylinder, or near the inner surface of the said cylinder; and the line of direction of said pipes or gates is not to be that of a perpendicular to said bottom or inner surface, but that of an oblique or slanting line, usually equal to about thirty degrees, *that is, approaching* the direction of a tangent *to the cylinder.* Beneath these openings, by which the pipes enter the main chill cylinders, is to be formed a circular chamber, with as many openings as there are pipes to communicate with the openings into the cylinder, and the pipes are to connect this chamber with the cylinder in the oblique or slanting direction above described; it is also advantageous to have this circular chamber closed by a partition across it, on one side of the opening in the circumference, left for the insertion of the descending tube, by which the fluid metal is to be poured in.

"This is the construction of my improvement; the manner of using it is as follows. The melted metal is poured in at the descending tube, by which it arrives at the opening at the bottom of this tube leading into the circular chamber; here the metal enters, and on one side being arrested by the partition closing the chamber at the side of this opening, the stream or course of the metal will be driven to the other, and, consequently, continued round. The partition is to be so placed as to give the course of the stream in the same direction round as that to which the pipes or gates lean.

"The metal flowing up these inclined tubes or pipes, acquires a rotary motion on entering the main cylinder, which is the object I wish to attain, thereby preventing the necessity of stirring with a rod; and this rotary motion is necessary, in order to bring the light substances to the centre, and throw the heaviest and best metal to the circumference."

A Cook Stove, *Joel Rathbone, New York.*—After stating that inconveniences have been experienced from the construction of the ordinary Jew's-harp, or flat cook stove, from the waste of heat, the burning out of the front oven plate, and the unequal distribution of heat through the oven, the patentee describes the improvements by which he proposes to obviate these inconveniences; they are, "first, in recessing, by a curve line or sweep, so much of the front furnace plate as lies below the kettles, in such manner as to bring the face thereof more or less under the bottom of the kettles; and, secondly, in opening on the back side between the furnace and the oven, and between the flue that passes over and the flue that passes under the oven, a horizontal passage for the air to circulate through."

A Fishing Boat, *John Donn, Washington.*—The advantage proposed to be obtained by the improvement in the fishing boat here patented, is, principally, an increased length of leverage for the oarsman. This is accomplished by extending wings on each side of the boat, from stem to stern, these wings being carried out horizontally by means of knees, thus widening the upper part of the boat, whilst that portion of it which is in the water remains as usual. The oarlocks are, of course, placed on the outer edges of these wings, which have the ordinary finish of gunwales. Some incidental advantages from this arrangement are mentioned, such as securing the boat from the effects of the swell, and thereby lessening the risk of foundering; the increase of room, also, for the seine, which, as usually placed altogether in the stern, raises the bow out of the water. The claim is to the wing constructed as above described, and applied to a fishing boat.

TAILORS' SHEARS, *John Andrews, New York.*—The upper side of the lower bow or ring of the shears, is to be made flat, or widened out, so that the fingers which press upon it in the act of cutting, may exert their power without the inconvenience experienced in the uses of shears as ordinarily made. The claim is simply to the widening out this part, as described.

WATER CLOSET, *James Stone, New York.*—This improvement consists of a pendulous weight attached to a rod, and connected by joints to the pan of the water closet. The specification refers throughout to a drawing, which exhibits the plan very perfectly. The contrivance is very simple, and appears to be extremely well adapted to its purpose, without a liability to get out of order.

AN IMPROVEMENT IN THE MODE OF CATCHING FISH, *Charles Fowler, and Edwin R. Hanks, Connecticut.*—A *steam-engine* is to be erected on the shore for the purpose of paying out the seine, and drawing the boats to the shore. Two blocks are to be fixed out in the stream at such distance apart as shall be equal to the length of the seine, and at the centre point between these blocks, two others; corresponding blocks are to be placed on the beach, so that two endless bands, or ropes, may be drawn around them, forming, when in use, two quadrangles. The ropes on shore are to be drawn by the steam-engine. Two batteaux, each containing one-half the seine, are to be drawn from the shore to the centre blocks, where they are to be cast off, and again made fast outside of the blocks; by drawing upon the ropes, the seine is then made to pay out each way to the outer blocks.

"What we claim as our invention, is the drawing the said boats from the shore around their proper circuits for paying out the seine, and then to the shore, by means of steam power, in the room of rowing; and likewise said drawing in of said seine by said engine."

We think the foregoing form of claim exceptionable, as it merely refers to the use of steam for drawing a rope, or ropes, which certainly is not the invention of the patentees; the proper subject of the patent, we apprehend, is the arrangement of the ropes to enable them to effect the purpose intended, whether steam or animal power be employed.

AN IMPROVEMENT IN THE USE OF THE SAW, *Anson Field, Jericho, Vermont.*— By the improved use of the saw, the patentee means an improved mode of fixing the saw for use, the purpose to which he proposes to apply it being, principally, the cutting of wood for the fire, in doing which he proposes to cut through a log at a single stroke, provided the saw be *long enough.*

Cheeks of wood, or iron, are to be fixed on each side of a saw, embracing it between them in such a manner, that at one end the teeth shall rise but little above them, whilst at the other the blade is to project sufficiently to pass through a log. This is then to be placed between slides, so as to allow it to slide back and forth like the frame of a mill-saw, "as may be most convenient," and "where thought best," "the timber to be cut confined to it as may be most convenient;" the saw to be moved "by means of any machinery thought best to attach it to." "By this process, a stick of timber of any size may be taken off by one sweep of the saw, provided it be of sufficient length, and width at the back end. The saw may be graduated so as to cut from half an inch to two inches to the foot, according to the size and nature of the timber to be cut." "What I claim is the manner of confining it between the two slips; the way in which it slides, and the principle on which it cuts, viz. being so confined as to cut, at one sweep, the entire width of the saw above the slips."

We have thus placed before the reader the whole sum and substance of the *invention,* and it will be perceived that those persons who wish to carry it into operation, are left at ample liberty to devise the means of doing so. It is probable that a twenty-horse power steam-engine may suffice to work the saw, and cut through a nine-inch log at a single sweep, a powerful screw-press, or some analogous instrument, being employed to hold the log.

PLOUGH, *William Hess, Pennsylvania.*—"The improvement for which the patent is asked consists in, 1st. The flanch on the mouldboard behind the share, to prevent that part of the plough cutting in the furrow, and thus running heavy. 2d. The running the landplate back to the plough-handle, and attaching it to the handle, and extending the cutter back to the handle, by which the plough is strengthened, and the earth will not fall over the landplate into the furrow.

3d. In extending the land side of the share back to the plough-handle, and attaching it to the landplate near such handle, by which the plough runs lighter, and there is less trouble in working from the whole of the land side to the share being in one piece." There are no references to the drawing.

Preparation of Chewing Tobacco, *Edward Chassaing, Baltimore.*—The tobacco manufactured by the patent process is denominated "*Natural Roanoke Leaf,*" and it is thus prepared: 250 lbs. of the best Virginia tobacco is to be sprigged in the usual manner, and sprinkled with a mixture made by boiling 3 lbs. liquorice, 2½ lbs. prunes, 1 lb. figs, 1½ lb. table salt, ⅓ gall. Jamaica rum, and 4 galls. water. The liquid is to be strained, and water enough added to make the liquid amount to four gallons. The tobacco is then to be lightly pressed, as discolouration would be produced by heavy pressure.

The claim is to "the manufacture of chewing tobacco in the manner hereinbefore described."

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NOTES AND NOTICES.

In Rebuilding that part of the Penitentiary that was burnt. I would suggest that the gutters should be lined with zinc instead of lead, which would be much more economical, and in case of another fire, might prevent its spreading in the manner so disastrously exemplified at the late fire; as I have heard that the lead guttering was melted, which left the ends of the rafters exposed to the flames, and was thereby the cause of their spreading to such an extent, which would not have been the case if zinc had been used, as it would have resisted the flames.—Henricus.

Steam-Plough.—At a meeting of the Grantham Agricultural Association, Mr. Hanley stated that he had seen a steam-plough at work in Lancashire, which did its work remarkably well, and turned up an acre of wet land, at a depth of nine inches, in 1 hour and 50 minutes.

Barton's New Safety Boiler.—(From a Correspondent.)—Mr. J. Barton, the well-known ingenious engineer, has, we are informed, just completed a new invention which promises to be of great utility, as an improvement in the construction of steam-engines; and also of importance as a means of diminishing the hazard to which the personal safety of individuals is now exposed, wherever steam-engines are used. This invention consists in a *safety boiler* upon an entirely novel principle, and which is so contrived as to afford every protection against injury from explosion. Independently of this primary recommendation, we understand that it combines the further advantages of cheapness in the original cost and economy in the consumption of fuel. Mr. Barton has not published a description of the plan upon which his model is formed, the patent-right not being yet secured. We must therefore postpone a further account of it until another opportunity, and can only add, that we are assured the invention is likely to prove a grand *desideratum* in the scientific world, and to give a new impulse to locomotive machinery; especially *in conjunction with the inventor's other improvements in the steam-engine*; viz., his patent *metallic pistons and lubricators,* which have long been extensively adopted, particularly in his Majesty's service.

Railway Phenomenon.—On Monday last a gentleman of this town, who had taken his place in the hindmost carriage of one of the railway trains from Bolton to Kenyon, witnessed the following singular occurrence:—He was placed with his back to the engine, and had a clear view of the receding line of railway. The train was going down the inclined plane from Bag-lane to Leigh, at the apparent rate of from 30 to 40 miles per hour. A man who was standing on the side of the railway threw a stone about the size of a hen's egg in a horizontal direction, and with considerable violence, at the train. The stone was distinctly seen by the gentleman in its progress to the carriage in which he was seated, and, having attained its maximum of velocity, it appeared, like Mahomet's coffin, to be suspended in the air for a few seconds within a foot of the gentleman's head. He seized hold of it, and he describes the sensation which he felt in doing so as somewhat similar to that which would be felt in grasping a stone, in a state of rest, suspended by a thread.—*Bolton Chronicle.*—[This is easily accounted for; both the train and the stone had attained the same velocity.]—*Manchester Advertiser.*

Sugar from Indian Corn.—M. Pallas lately presented to the Academie des Sciences of Paris a sample of this substance, extracted from the stem of the plant, which has been found to contain nearly 6 per cent. of sirop boiled to 40 degrees, a part of which will not crystallize before fructification; but it condenses and acquires more consistency from that period to the state of complete maturity. The most favourable time to obtain the greatest quantity of sugar, is immediately after the maturity and gathering of the fruit. The matter left after the extraction of the sugar, is capital to feed cattle or to make packing paper.

An Air Violin.—A newly and ingeniously invented instrument has lately been presented to the Academie des Sciences of Paris, by M. Isoard. It resembles the common violin, with the strings extended between two wooden or metal blades; it is vibrated upon at one end by a current of air, while at the other the player presses on them, shortening them by the pression of the finger. In fact, the strings of this instrument are acted upon by a current of air, instead of the common bow. The sounds vary between those of the French horn and the bassoon.

Philo-Scrutator having made his choice (for which we by no means blame him), has no fair claim upon our pages. Besides, all the arguments he makes use of against the Pneumatic Railway scheme are already quite familiar to our readers.

Communications received from Mr. Lush—Mr. Brett—O. G. P.—Mr. Ambrose—Non-Ego—Medicus—Mr. Henderson—Mr. Chapman.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price *6d.* Also, the volume complete, in boards, price *9s. 6d.*

☞ Patents taken out with economy and despatch; Specifications prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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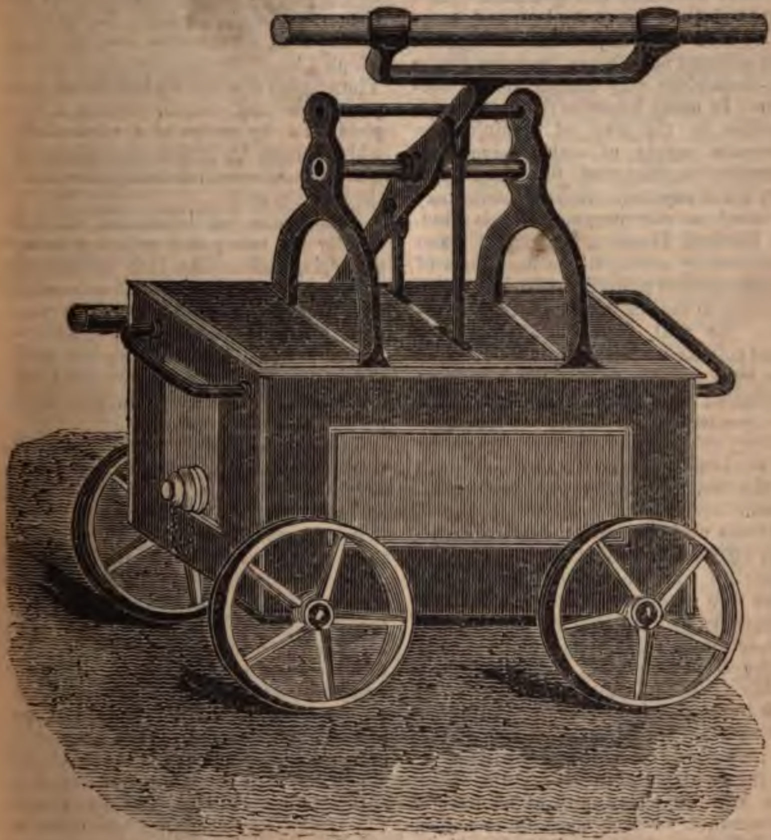
MERRYWEATHER'S IMPROVED FIRE-ENGINE.



MERRYWEATHER'S IMPROVED FIRE-ENGINE.

Sir,—The late melancholy loss of life, and lamentable destruction of property by fire, at Hatfield House, Hertfordshire, shows the necessity of furnishing all such places with some ready and convenient means of checking the progress of fire.

It is highly desirable that *all* the country seats of the nobility and gentry should be provided with fire-engines, and also with an adequate quantity of water, to supply not only their own, but also any other engines that may be brought to assist in suppressing a fire.

Many noblemen and gentlemen have fire-engines on their premises, and thereby render incalculable service to their less affluent neighbours, and also obtain for themselves very considerable protection. In many localities the natural difficulties in the way of obtaining an adequate supply of water, have been completely surmounted, sometimes at a very great expense. Belvoir Castle may be cited as one instance of this kind. At Hatfield House a scarcity of water considerably abridged the usefulness of the prompt and powerful assistance which crowded to the scene of danger. However, the zeal, intrepidity, and judgment collected upon this occasion, made the best possible use of the means at command, and their exertions arrested the progress of the flames at a comparatively early period of their career, by far the largest and most valuable portion of the building being preserved uninjured.

It was well observed, "that extraordinary efforts alone could distinguish any, where all were so active;" but among those who were stated to have signalised themselves by extraordinary exertions on this occasion, especial mention is made of the Honourable W. C. Talbot; also of West, of the County Fire-Office, who, with his engine from London, arrived on the spot at an advanced stage of the fire; his steady coolness and activity were the theme of praise in the mouths of all who had an opportunity of witnessing his conduct. I had occasion to notice the gallantry of West at the House of Lords' fire, and I have much pleasure in paying this additional tribute to his meritorious and praiseworthy exertions.

Among the fire-engines present on this *occasion, a small one* belonging to the Marquis of Bute elicited the warmest approbation, being conspicuous for its excellent working, and for the important aid it rendered in stopping the fire. This kind of engine seems particularly well adapted for the use of country seats and mansions, and it is already very extensively employed by the nobility and gentry.

I send herewith a drawing of this engine as now constructed by Mr. Merryweather,* many years foreman with, and now successor to, Messrs. Hadley, Simpkin, and Lott, engine-makers, Long Acre, London. This engine is upon their patent principle, with metallic valves and pistons, and separate valve chambers; a principle of construction now generally adopted in all the most approved engines. The engine can be worked from water poured into the cistern, or from a river, pond, &c., by means of a suction-pipe, which screws on at one end of the engine, the delivery hose being attached to the opposite end.

This engine can be worked either by four or six men; and with a nose-pipe seven-sixteenths of an inch in diameter, will throw a steady column of water about sixty feet high. With a half-inch nose-pipe, for close combat, the interior of buildings, &c., it delivers a great quantity of water, with steadiness and precision, and without much fatigue to the persons at the handles.

This engine is simple in its construction, neat in appearance, and possesses all the requisites for useful and efficient service. Its parts are few and not liable to injury, but should any little derangement take place, it can be readily got at and rectified; each part being capable of separate inspection and repair, without the disturbance of any other parts. The metallic valves are very perfect, and beautiful pieces of mechanism, decidedly the best I ever saw.

This form of engine has been patronised and adopted by the proprietors of mansions in many parts of the United Kingdom. His Grace the Duke of Rutland has one of them at Belvoir Castle. The Duke of Devonshire has three at Chatsworth House. Mr. Merryweather has made four, a size larger than the one from which the sketch was taken, to be worked by six or eight men, for the Duke of Northumberland, two for Sion House, and two for his Grace's seat at Alnwick.

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* Also the inventor of the ingenious fire-escape described at p. 290 of your thirteenth volume.

Mr. Merryweather has recently introduced an improvement in the branch pipes of fire-engines, which contributes very materially to their effect. By an alteration in the form of the nose-pipe, he obtains a more compact stream of water, and consequently delivers it at a greater elevation than with nose-pipes of the ordinary form.

However, these improvements, with the details of some experiments recently made with nose-pipes of different shapes, will form the subject of a future paper; meantime,

I remain, yours respectfully,
W. BADDELEY.

ELECTRICAL THEORY OF THE UNIVERSE.

BY MR. THOMAS S. MACKINTOSH.

The whole economy of nature, so far as we know, is guided by one general principle—production, destruction, and reproduction. Throughout animated nature this rule holds without exception—"one generation passeth away and another cometh,"—nothing is stationary—all is in a state of progression. The rule holds with the same force in vegetable life; and in the mineral kingdom, although the progression is slower and less obvious to the general observer, yet, so far as we are acquainted with it, the progression is exactly the same. If this rule holds throughout all the works of nature with which we are acquainted, the inference is just and well founded, that the same rule and order may hold also in those higher and more remote operations with which we are to a certain extent unacquainted.

The author of the following theory has been led into this train of reflection from observing the very vague and futile uses which some philosophers have assigned to comets in the general economy of nature. Some have informed us with all due gravity, that they may possibly be abodes prepared for the reception of the wicked, where they will be exposed alternately to the pain and misery of extreme heat and cold. This theory is beyond the sphere of natural philosophy. Others have supposed that they are destined at some future time to be used as agents in the destruction of this planet. Now I hold it to be a physical impossibility that a comet can ever approach this earth sufficiently near even to disturb the settled order of the seasons in any material degree, much less to cause its utter destruction. Comets, in my opinion, are not agents for the destruction or derangement of any of the planets in the solar system; but, on the contrary, very important and essential instruments for their regeneration.

I am aware that various hypotheses have been, from time to time, submitted to the world upon this subject; but, unfortunately, their authors have endeavoured to draw their corroborations from sources entirely foreign to natural philosophy. They have perplexed themselves in forming hypotheses that should accord in all their parts with the Mosaic accounts of the creation and universal deluge. They imagined that their theories demanded credence, and derived support in proportion as they could be strained to coincide with the Holy Scriptures; and that the truth of the Scriptures was attested by corroborations drawn from natural philosophy: now, in my opinion, the Scriptures stand in no need of such aid, and natural philosophy has no right to seek support from writings of divine inspiration. Every kind of work must be judged by the congruity of its parts, and the facts and arguments adduced in support of the proposition sought to be established. When the Scriptures are tried by this test, they are not found wanting; but if we apply the same rule to the different theories of the universe that have been submitted to our judgment, we shall find little difficulty in discovering discrepancy sufficient to invalidate the whole hypotheses. However, it is not our present business to show that the theories of our predecessors are erroneous; we will leave them to the judgment of the world, by which this also must be tried.

This sketch is published rather with a view to elicit the opinions of scientific men upon the subject than to establish a theory. With regard to the mere theory, perhaps no one cares less than the author himself, and if the voice of the scientific world should pronounce it visionary and absurd, no one will smile with more complacency. If the appearances of truth or probability shall be found in the estimation of the world in favour of this system, it will gain ground in every discussion that may ensue upon its promulgation; on the other hand, if the appearances of probability shall be found against it, it will soon be consigned to oblivion.

Theory of Matter.

All matter contained in the solar system, of whatever description, has, at one time or other, emanated from the sun, into whose body it will again return, again to emanate, again to return, and so on *ad infinitum*.

1. A comet is an immense volume of aeriform or gaseous matter, in a highly electrified

state, expelled from the sun by an extraordinary effort; and is the result of certain specific modifications of electricity in due accordance with the laws of nature.

2. A comet is projected from the sun in an elliptical curve; and the eccentricity of its orbit is determined conjointly by the sun's rotary motion, and the tangent at which it is at first projected.

3. In the course of a series of revolutions the component parts of a comet become more dense and compacted, its orbit less elliptical, its projected distance from, and its approximation to, the sun become less in nearly an equal ratio.

4. When the orbit of a comet has become nearly a circle, and its component parts are sufficiently settled and condensed, it takes its station on the verge of the solar system and becomes a planet.

5. When several comets are matured and settle into the planetary state about the same time, the largest and densest of the group becomes the primary, attracts the smaller comets to its sphere, and these become its secondaries.

6. Through every successive revolution the secondaries approximate nearer and nearer to, and ultimately fall into, the body of their primaries.

7. The planets through every successive revolution approximate nearer and nearer to, and ultimately fall into, the body of the sun.

Theory of Motion.

All motion throughout the solar system is effected by the agency of electricity, both the larger operations exhibited in the motion of the planets and the minuter processes of vegetation, oxidation, and vitrification; and each specific and distinct mode of motion or action is caused and directed by specifically distinct modifications of electricity, the relative circumstances controlling its operations being appreciated.

1. The earth and all the planets of the solar system are maintained at their respective distances from the sun and from each other by the relative proportions of positive and negative electricity with which each is charged.

2. In carrying on the vegetative and other processes of nature, the electric fluid of the earth and other planets is gradually dissipated, and the repulsive power between the sun and planets is weakened in a corresponding ratio.

3. As the electric fluid of Mercury, Venus, the Earth, and other planets, becomes each necessarily exhausted, the repulsive power will become extinct, and each will, in the order of their succession, merge in the body of the sun.

4. In like manner, as the electric fluid of the moon and other secondaries becomes exhausted, the repulsive force between the primaries and their secondaries will become extinct, the moon will merge in the earth, and each secondary will merge in the body of its primary.

5. The earth's rotatory motion is an effect of the electrical agency of the sun acting upon electrical matter contained and circulating within the cavernous body of the earth, and diffused throughout the external crust composing the earth's surface.

6. As the earth and other planets are continually approximating towards the sun in spiral orbits, they are in effect propelled down an inclined plane by the power of electricity.

There are two theories of electricity; one is called the Franklinian theory, from being proposed by Dr. Benjamin Franklin, wherein it is assumed:—

1. That there exists in all bodies a subtle fluid called the electric fluid.

2. That some bodies called conductors are capable of holding or retaining a larger quantity of electricity than other bodies called non-conductors.

3. That non-conductors have so little affinity for electricity, that the quantity they contain can be extracted from them by friction, and transferred to conducting bodies, which have more affinity for electricity.

4. That the body that is filled or positively charged with electricity will attract the body that is emptied or negatively charged; and that the attraction will be powerful or weak in proportion as the positive body contains more, or the negative body less, than its natural quantity of electricity.

5. That two bodies, both filled or positively charged with electricity, will repel each other.

6. That two bodies, both emptied or negatively charged with electricity, will repel each other.

It is objected to the 6th article of this theory, that as two bodies both emptied of electricity repel each other, the electric fluid cannot be the cause of this repulsion, seeing they are both emptied. Some attempt to explain this difficulty by saying, that if the electric fluid be withdrawn, matter has an affinity for, and will attract, other matter; and that it is only prevented from doing so by the repulsive power of the electric fluid with which all bodies are charged or filled in their natural state.

Others, not content with this explanation, have recourse to another theory, proposed by Du Fay, which assumes that there are two electric fluids, one called the vitreous and the other the resinous. The explanation of this theory is a mere repetition of the first with a change of terms, vitreous being substituted for positive, and resinous for negative electricity. However, as a clear comprehension of the known laws of electricity is essential to a right understanding of this theory of the solar system, we will state Du Fay's theory of the two electricities:—

1. If a cylinder of smooth glass is excited by friction, vitreous electricity is obtained.

2. If a cylinder of sealing-wax is excited, resinous electricity is obtained.

3. Two bodies charged with vitreous electricity will repel each other.

4. Two bodies charged with resinous electricity will repel each other.

5. Two bodies, the one charged with vitreous and the other with resinous electricity, will attract each other.

The state of our knowledge in the science of electricity is not sufficiently advanced to enable scientific men to pronounce with certainty which of these two theories is the true one, although Du Fay's is generally considered to be nearest the truth; but Franklin's is often preferred in treating on the subject, on account of its greater simplicity, and on that account we shall adopt Franklin's terms of positive and negative in the present case, without offering any opinion as to the truth of either theory. We should prefer that of Du Fay, and are of opinion that it would square much better with our own than Franklin's; but minds unaccustomed to the science are apt to get confused amongst the various substances having greater affinities for the one or the other species of electricity. To the scientific reader either theory is alike acceptable, as he can readily change the terms, and the application becomes nearly the same.

Setting aside all theory for the present, we will proceed to examine such general facts relating to the science of electricity as have been developed and confirmed by the experiments of scientific men. These general facts are usually reduced to the six following heads:—1. Excitation; 2. Attraction; 3. Repulsion; 4. Distribution; 5. Transference; 6. Induction.

1. *Excitation.*—"If a piece of amber or sealing-wax or a smooth surface of glass, perfectly clean and dry, be briskly rubbed with a dry woollen cloth, and immediately after held over small light bodies, such as pieces of paper, thread, cork, straw, feathers, or fragments of gold leaf, strewed upon a table, these bodies will be seen to fly towards the surface that has been rubbed, and adhere to it for a certain time. The surfaces which have acquired by friction this attractive power, are said to be *excited*, and the substances, thus susceptible of excitation, are termed *electrics*, in contradistinction to such as are not excitable by a similar process, and which are therefore termed *non-electrics*." In the tables of conducting and non-conducting bodies, gold is usually placed at the head of the list of non-electrics, and is considered the best known conductor of electricity; at the head of the list of electrics is placed gum-lac, which is considered the best insulating body or non-conductor. But in the electrical machines, a glass cylinder is commonly used as an electric, and a hollow brass cone, each end terminating in a hemisphere, as a conductor. The glass cylinder is mounted on an axis and supported by two glass pillars, for the purpose of insulating it or cutting off the communication between the cylinder and the earth, as electricity will not pass through the glass pillars, that substance being a non-conductor. The handle by which the cylinder is turned must also be of glass, otherwise the electricity will pass into the earth through the arm and body of the operator. These arrangements being made, if the handle be turned round briskly, and a piece of silk or woollen cloth be held against the cylinder with a pressure sufficient to cause a moderate degree of friction upon the surface of the glass, electricity will be accumulated in the cylinder. This is the process of excitation. We know nothing whatever of the nature of this process; all that we know is, that with the same arrangements and means electricity is invariably accumulated in the glass cylinder, and that is sufficient for our present purpose.

2 and 3. *Attraction and Repulsion.*—The glass cylinder being now charged with positive electricity, or filled with electric fluid, will attract the metallic conductor, which is in its natural state; but if the conductor be negatively charged or emptied of the electric fluid, the attraction between the two bodies will be proportionately more powerful and intense; if the negative conductor be now presented to the positive electric, a portion of the redundant fluid will be transferred to the conductor, and the two bodies being both positively electrified, will repel each other; the same effect will be produced if the bodies are placed at a certain distance, and a metal ball suspended between by means of a silk thread, or any other insulating substance, the ball will be attracted and repelled by each, alternately, until the electric fluid is reduced to an equilibrium in the two bodies, the ball extracting the fluid from the full body and carrying it to the empty one until this is accomplished. The manner in which this is effected must be particularly noted, as we shall have occasion to refer to it when we come to treat of comets.

4. *Distribution.*—It has been ascertained by experiment, that in bodies charged with electricity, it is not distributed equally throughout the mass, the quantity a body is capable of receiving, depending more upon the

extent of surface than the solid contents; that a metallic conductor in the form of a globe contains just as much electricity when hollow as it does when solid. It therefore appears, that the electric fluid resides chiefly in the surface of the body; and hence we may conclude, that the active electricity with which the earth is charged, is almost wholly diffused throughout the external crust composing the earth's surface. We shall have occasion to notice this peculiarity when we come to treat of the earth's motion on her axis.

5. *Transference.*—We have seen, that if a body be filled or charged with electricity, and an empty body brought in contact with it, the redundant fluid will be transferred from the one body to the other; and that there is a continual tendency in the two bodies to effect this transference, is evinced by their attraction for each other; and if the two bodies are allowed to come in contact with the earth, the whole charge will be drawn off into the earth, which is the great conductor and reservoir of electricity.

6. *Induction.*—The reader will find an explanation of this law in the former letter exemplified by the two balls.—*Mechanics' Magazine, No.* 634.

It is absolutely necessary before entering upon the following theory, that clear and correct ideas of the sciences of electricity and of the galvanic circle, should be formed in the mind of the reader; and if he is somewhat acquainted with chemistry, he will be able to draw deductions for himself from this knowledge, which are not adverted to in this short treatise; in short, the whole circle of the physical sciences lend their aid and support to the hypothesis that follows, and had our own knowledge extended farther, we should undoubtedly have been enabled to furnish arguments still more convincing than those that have been adduced; but we are satisfied that the fundamental principle of our theory is correct—that the arguments advanced (and they are but a small number compared with the vast body that might be collected by a more intimate and extended knowledge of the electro-chemical operations of nature in her own vast laboratory), must carry conviction home to every philosophic mind. In the leading principles of our theory, we find that they conform very closely to those of Sir Isaac Newton, and we point to this feature with no small satisfaction. Newton explained the effects with precision, but he failed in not tracing the cause of motion to the all-pervading power of electricity: this defect must be considered as arising from the circumstance of electricity being *almost wholly unknown* as a science in the *days of Newton, otherwise* it could not have *escaped* the search of his powerful and discriminating mind. The materials from which he drew his deductions were few and scanty, compared with the stores that have since been opened to our view by the laborious researches of scientific men, but he made the most of his meagre stock, and found his way to the Temple of Science by intricate and narrow paths, with a certainty and precision most wonderful; he opened the way, and enabled us to proceed with some degree of confidence; and we humbly presume, that in the following theory we have advanced one step in the path of science.

It is further necessary that a slight acquaintance with astronomy should be obtained in order to understand this theory correctly. It will be sufficient for this purpose to know that the sun is fixed in the centre of the solar system; that he revolves on his axis in twenty-five days; that he is more than a million times larger than the earth, and that there is evidence of his being composed of the most active elements; that he is surrounded by planets which appear to be of a nature similar to this earth; that these planets revolve round the sun in a circular orbit, forming their years and seasons, and also turn on their axis forming days and nights, and that some of these planets have also smaller bodies, called moons or satellites, revolving round these somewhat in the same manner.

Development of the Theory of the Solar System.

1. *Centre of Positive Electricity.*—The body of the sun has a powerful affinity for electricity, and is intensely charged with electric fluid; and is surrounded with an atmosphere of electricity extending to the utmost limits of the planetary system, decreasing in density in a certain unknown ratio with its distance from the sun. The sudden appearance and disappearance of spots on the sun's disc affords proof, even to demonstration, that the elementary matter of the sun is, at intervals at least, in a state of violent commotion; and when we consider that some of these spots are much larger than the earth, how vast must be the effort to cause them to appear and to disappear in so short a space of time as they have been known to do! There is no known agent in nature capable of producing such vast results except electricity; and this consideration alone almost forces the conclusion upon us, that the sun is an immense spherical conductor, highly charged with electric fluid. " The light obtained by voltaic electricity exceeds in intensity any other that art can produce; it is so dazzling as to fatigue the eye even by a momentary impression; it is a light which so nearly emulates the sun's rays, as to be applicable for the purpose of illuminating objects in a solar micro-

scope. All this accords with the light of the sun." We will not discuss the point as to how the voltaic light is evolved, since, whatever may be the nature of the process, it appears that the presence of electricity is essential to its exhibition. We are, therefore, justified in the conclusion, that as both lights have some properties in common, they are to a certain extent identical. If this conclusion be correct, it might be supposed that we should be enabled to detect electricity in the sun's rays. In the *Journal des Progres des Sciences*, this is said to have been effected by Professor Salvenio Barlocci, of Rome, who states, that when two pieces of copper, painted black, one of them connected with the upper part of a frog, and the other with the hind feet, were placed one of them in the red and the other in the violet ray of the solar spectrum, and then brought in contact, that contractions took place in the muscles of the frog. This seems to indicate very pointedly the existence of a certain specific modification of electricity in the sun's rays; and if in the rays proceeding from the sun, the conclusion that the sun is highly charged with electricity becomes irresistible. Although light and heat may be, to a certain extent, connected with our subject, we will pass them over for the present, as their consideration would lead us into too wide a field and create confusion. We wish to consider the sun simply as the prime, positive, electrical conductor of the solar system; and with a view to fix this idea permanently in the mind of the reader, we have denominated him the "centre of positive electricity."

2. *Region of Negative Electricity*.—That part of space which surrounds the solar system on every side beyond the range of the planets, we shall denominate the region of negative electricity. We shall assign no properties whatever to this region, unless vacuity may be considered a property, not a perfect vacuum, but nearly so, and especially as regards the electric fluid; it will, therefore, have a powerful attraction for electricity, which, however, it cannot retain, for two reasons:—1. This region contains no substance upon which the electric fluid can fix; this is evident to the senses, for if the immense space between the earth and the fixed stars were filled with any substance but the most subtle ether, it would be utterly impossible that the stars could be seen. 2. There are strong reasons for the assumption, that all matter issuing from the sun becomes decomposed in this region, or undergoes some specific change, and returns to the sun under its new modification. That this process must be continually going on is evident, otherwise even the immense bulk of the sun must have been dissipated long ere this time, from the vast volumes of matter continually issuing from his surface. We consider, then, that this space is in a state of negation as regards the electric fluid, and, therefore, has a powerful attraction for electricity. An objection may be raised to this assumption, upon the ground, that as this region is alleged to contain no matter upon which the electric fluid can fix, it cannot, therefore, be supposed to attract electricity; but since we know from experiment that the more the air is rarefied, the less resistance is opposed to the passage of electricity, and that there is a constant tendency in the fluid to escape from the charged body, as is evinced by its distribution in the surface—it may be conceded, that this region offers facilities to the ready dispersion of the electric fluid from the charged body, and this concession is all that is required.

3. If we regard the sun as the prime positive conductor of the solar system, very intensely charged with electricity, it will not be difficult to conceive him capable of emitting a body of vapour containing a much larger quantity of matter than any comet or planet in the system. If we consider that the sun is more than a million of times larger than the earth, the emission of a comet may be regarded merely as a spark drawn from the prime-conductor: comets of great brilliancy have been observed receding from the sun, whose approach to that body had not been detected by diligent observers; in the absence of direct proof, this circumstance alone is almost sufficient to justify the inference, that that body had just commenced its long and unwearied journey around the solar system. We might refer to volcanic eruptions in the earth in support of this hypothetical proposition; but when we consider the vast concentration of electrical power in the sun, and refer it to the comparatively feeble efforts of volcanic fire, the illustration is too faint to convey an adequate idea of the force of electrical action. An evidence of violent internal commotion is furnished by the immense moving spots that have been observed on the sun's disc; and we know that in all the natural phenomena that come under our immediate observation, if there is violent internal action, there is a constant tendency in the excited body to relieve or deliver itself of a portion, at least, of the exciting cause of the commotion. There is nothing extravagant then in the assumption, that comets are discharged from the sun: the supposition is in perfect accordance with the known phenomena of nature, and entirely within the range of natural probabilities.

4. If the sun were in a state of rest, a comet would be projected in a straight line, but as he revolves on his axis with great rapidity, it is projected in a curve, which is the beginning of a circle, that is to be de-

scribed by the comet in all its future revolutions around the solar system. If we might be permitted to use a homely illustration, that should bring this idea clearly within the conceptions of minds of the humblest capacity, we should say, that a comet is projected from the sun somewhat in the manner that sparks are emitted from the surface of a knife-grinder's wheel. As the projectile force is greater than that derived from the sun's rotary motion, the elliptical form of the comet's orbit is determined by the two forces conjointly in a ratio corresponding with the force of each respectively. Now as the sun and comet are both highly charged with positive electricity, it follows from the established law that two positive bodies repel each other, that the comet will be repelled with a velocity corresponding with the intensity of the charge in each of the two bodies, and as negative and positive bodies attract each other, it will be attracted with an equal power into the region of negative electricity; but as the attractive power of this region is equal on all sides, the comet will not be attracted to any given point, but will follow the original curvature of its orbit first imparted upon its emission from the sun; as the comet penetrates into the region of negative electricity, its charge will be gradually withdrawn or dissipated; and as this process proceeds, the velocity with which it moves must necessarily decrease, and, at a certain point, the attractive and repulsive forces must be in equilibrio, until at length the whole, or nearly the whole, of the charge is withdrawn, and the comet being now negative, is attracted by the sun, and repelled by the region of negative electricity. As the nucleus and materiel of the comet has a strong affinity for the electric fluid, as it approaches the denser part of the sun's electric atmosphere, it will imbibe the fluid, and, consequently, cannot enter into the body of the sun, but will be again repelled in an orbit less elliptical than that described in its first revolution. In order to form a competent conception of the manner in which this effect is produced, we must refer to the electrical phenomena exhibited by a stream of electricity in its passage between the two points of a positive and negative conductor: here we perceive, that "the velocity will carry the particles that have deviated from a direct course somewhat beyond the point to which they are attracted; while the attraction to this latter point will tend to deflect them from the line of their path, and gradually turn them back, so that they will arrive at the point of attraction by a retrograde motion." Now as the deflection must necessarily correspond with the size of the *point of attraction,* and as the sun is a body *of immense magnitude,* it follows that the comet will be deflected in its path in a curve corresponding with the circle of the sun's electrical influence; and as the repulsion between the sun and comet is an increasing force at the period of the latter's perihelion; and as this repulsive force is exerted equally on all sides of the sun, a portion of this force must press laterally on the comet in its orbit, thereby tending to widen the ellipsis. This part of our theory derives a support almost amounting to demonstration, from the fact that "when comets first make their appearance, they generally resemble a round film or vapour, with little or no pretensions to a tail, but they increase in brilliancy and the acquisition of a tail as they draw near to the sun; but it is after they have passed their perihelion, when emerging from the brilliancy of the solar light, in which they have been for a short time obscured, that they assume their greatest splendour; the tail which, during the approach to the perihelion, had followed the comet, now precedes it generally with a small degree of curvature, probably arising from the resistance of the ether, which is supposed to pervade all space." The increased brilliancy must be ascribed to the increased quantity of electric fluid that the comet has imbibed in its passage near the sun; and the tail being projected from the sun, is plainly to be referred to the repulsive force exerted between two bodies both positively charged, or, perhaps, with more strict propriety, to the inductive influence of electricity, repelling and concentrating the electric fluid in the remotest part of the comet's tail. Now as the comet cannot be so highly charged by passing through the electric atmosphere as when first disengaged from the sun, it follows that the repulsive power is weaker, and that, consequently, it will not be projected to the same distance as in its first revolution. From these considerations we draw this conclusion, that in the course of "series of revolutions, the orbit of a comet becomes less elliptical; its projected distance from, and its approximation to, the sun becomes less in nearly an equal ratio." We must further observe, that during the cometary state, the materiel of the comet undergoes certain specific changes relative to its electric functions; the tail is gradually absorbed by the nucleus, and when its orbit is reduced to the planetary form, it takes its station in the exterior circle of the planets, a well-matured and compacted body, a fit recipient and supporter of vegetable life.

5. We have laid it down as a fundamental law in this theory, that the earth and all the planets of the solar system are maintained at their respective distances from the sun, and each other by the relative proportions of positive and negative electricity with which

each is charged; and we further assume, that the positive charge is a continually decreasing quantity from the time of a comet's first emission from the sun, until it finally falls back into that body a worn-out and exhausted planet. We have no data whatever which would enable us even to attempt to fix the time occupied in accomplishing these vast operations of nature; each specific change in bodies of such immense magnitude must require periods of vast duration; compared with which, the age of human records is but as one day. We are assured by experiment, that the attractive and repulsive forces of electricity follow the same law as to its intensity, that is, the inverse ratio of the square of the distance. Let this be compared with the laws of Kepler, and we think the conclusion cannot be resisted, that the motions and distances of the planets are regulated and determined by this powerful and all-pervading agent. If we endeavour to estimate by the operations of sense the manner in which the planets are said to be propelled in their orbits with such amazing velocity, we feel a difficulty in perceiving the cause of motion—the effect is admitted, but the cause is not discernable; but if we refer all motion to the agency of electricity, the cause and effect are joined before our eyes; we refer it to an ever-active and known power, appreciable by the senses, pervading all known space, and whose rapid motion corresponds with the motion of the heavenly bodies; and if we allow the assumption, that the quantity of positive electricity with which the earth and all the planets is charged, is a continually decreasing quantity, the cause of motion in their orbits becomes plain and palpable; they are in effect attracted and repelled down an inclined plane by the power of electricity.

6. *Earth's Motion on its Axis.*—Hitherto we have referred all motion to the agency of electricity, as it is developed and exhibited by the excitation of electrics; but that we may be enabled to discern clearly the cause of the earth's motion on her axis, we must refer to the galvanic circle, a clear conception of which is necessary to a right understanding of this part of the theory. Now we hold, that the crust of the earth, sea, and land, is nothing, more or less, than a galvanic circle, or, perhaps, more correctly, a series of circles, or rather a voltaic battery; but we wish to preserve the idea of the simple circle, because it furnishes us with a more clear and distinct explanation of the cause of the earth's motion on her axis than the voltaic pile. We assume, then, that there is a continuous stream of galvanic electricity circulating throughout the earth's external crust, and that the main current is round the equator; that the earth's inclination to her orbit is determined by the direction of this current, and that it has more influence in raising the temperature of the climate within the tropics than that exerted by the sun's vertical rays. Now, it is evident, that if the galvanic circle were undisturbed, the fluid would continue to flow around the earth, and the earth would remain at rest; but the inductive influence of the sun destroys the equilibrio, and the earth revolves. So satisfied are we of the truth of this part of our theory, that we feel convinced that if a sphere were mounted upon two centres, with a galvanic circle formed round its equatorial circumference, correctly balanced, and placed in a proper position between a positive and negative conductor, highly charged, the sphere would be found to revolve so long as the galvanic action continued. And so long as the galvanic action continues in the earth, she will revolve upon her axis, and no longer. Upon this principle we assume, that the galvanic action in the moon has ceased altogether, or become so weak that the current cannot overcome the power of the earth's induction; and as the planet Jupiter turns on his axis in ten hours, whilst Mercury requires twenty-four hours, we infer from this that Jupiter is a good conductor of galvanic electricity, whilst in Mercury the fluid flows with more difficulty.

7. We have assumed that the quantity of positive electricity with which the earth and other planets is charged is a continually decreasing quantity. Before entering upon this proposition we would solicit attention to the following:—*If there could exist a power having the property of giving continual impulse to a fluid in one constant direction, without being exhausted by its own action, it would differ essentially from all the other known powers in nature; all the powers and sources of motion with the operation of which we are acquainted when producing their peculiar effects, are expended in the same proportion as those effects are produced.* Now, we have laid it down as a fundamental law in this theory, that all motion is effected by the agency of electricity, and that the processes of vegetation, oxidation, and vitrification, and other processes respectively, are carried forward and effected by specifically distinct modifications of the electric fluid. The effect of electricity in quickening the process of vegetation has been repeatedly verified by experiment, and is, therefore, to be considered as an established fact in science. If a plant contained in a pot be subjected to the influence of electricity, the growth will be quickened, and the plant will arrive sooner to a state of maturity; on the other hand, if the plant be secluded from the influence of the sun's rays, and otherwise insulated as much as possible from the electric influence,

it is found that it cannot be brought to maturity by the most careful and elaborate processes of art. So essential is electricity, like a quickening spirit, in laborating and perfecting the process of vegetation. The powerful effect of voltaic electricity in eroding or oxidising metallic substances, is evinced by its action in the galvanic circle; and to prove that its power and influence extends over the whole range of terrestrial substances, we need only refer to the experiments made with the battery of the Royal Institution, wherein it was seen, that when the fluid was highly concentrated, platina melted in it as wax in the flame of a candle; some of the more refractory substances, as quartz, the sapphire, magnesia, and lime, all entered into fusion; fragments of diamond, points of charcoal, and plumbago, quickly disappeared, and seemed converted into vapour. Now, as the sources of motion are exhausted in the same proportion as the effects they produce, if this rule be applicable to voltaic electricity, we are justified in the inference, that the earth's galvanic influence will exhaust itself. We make no attempt to limit the extent of its duration, or to fix the number of galvanic circles that may be formed successively, as each of the preceding is exhausted; all that we mean to infer is, that in every successive action the elements become changed in their chemical and electrical properties and affinities, and rendered incapable of being acted upon again under the former circumstances; and that when the whole round of chemico-electrical processes shall have been operated, chemical action will cease, the galvanic circle will be incomplete, and the earth, like the moon, will cease to revolve on her axis. It is further assumed, that in proportion as the voltaic electricity circulating within the crust of the earth proceeds in oxidising and vitrifying the various conducting substances on which it operates, the earth's affinity for electricity is weakened; and as the internal fluid is continually being evolved by the internal action, whilst the capacity of the earth for attracting and retaining the electric fluid is becoming feeble in a corresponding degree, and, consequently, the earth is approximating nearer and nearer to a negative state, and is, therefore, attracted nearer and nearer to the sun, until it ultimately falls back into the sun a worn-out and exhausted planet. All this corresponds with the natural phenomena that comes undes our immediate observation; wherever we see organized life, we see that it has a birth, that it comes to maturity, and gradually decays; wherever we see motion, we see that it exhausts itself in a ratio corresponding with its intensity; and, therefore, reasoning from analogy, we are justified in *the inference, that the* same rule and order *may hold also in the heavenly* bodies.

8. That the moon is gradually approximating towards the earth is an obvious corollary of the foregoing theory; and here we shall be enabled to draw our inferences from two sources, astronomy and geology; and, consequently, in the latter, from matters that come more immediately under our observation, for we hold, that at one time the earth occupied the places now occupied by Georgium Sidus, Saturn, and Jupiter, each respectively in the order of their succession; that at that period of her existence she was of much larger diameter than at this present time, and was probably attended by three, four, or more moons, the wrecks of all of which, save one, are now scattered upon the surface of the earth—and in these wrecks we expect to find further evidence of the truth of our theory.

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PARKIN'S PATENT RAILWAY.

The stone sleepers on which most of our modern railways are laid, are not only excessively expensive articles, but articles as to the utility of which both practical men and men of science are but little agreed. Without going at present into a discussion of this *quæstio vexatio*, we desire to bring under the notice of our readers an invention, the object of which is to supersede stone sleepers altogether, by something said to be quite as durable, and, we presume, much less expensive (we speak doubtingly as to the last point, because we have no satisfactory information upon it before us). We allude to the plan of railway for which Mr. Thomas Parkin has recently taken out a patent. The material which this gentleman wishes to substitute is vitrified earth; and instead of large sleepers with intervals between them, he proposes to have a continuous line of sleepers, locking one into another, in the manner represented in the accompanying engravings.

Fig. 1 represents a rail mounted on three continuous sleepers *ddd*, each locking into the other, and bedded on patent felt *eee*, with iron bolts *ffff*, which gripe the rail at each end, holding it firmly down to the sleepers.

Fig. 2 represents the end of one of the sleepers with the rail *g* mounted upon it.

Fig. 3 represents a section of the rail and the middle sleeper *hh*, with a long screw *i* in the middle, which goes through a hole in the sleeper and enters a piece of wood *a*, which fills up the hollow of the sleeper b, as shown at fig. 5, and holds the rail in the middle firmly down to the

Fig. 1.

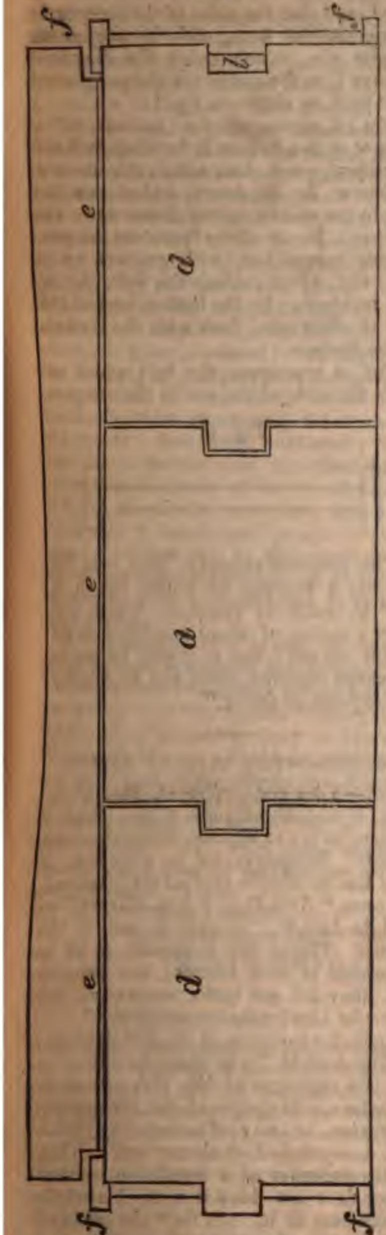


Fig. 2.

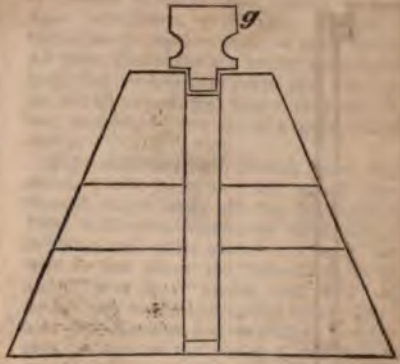


Fig. 4.

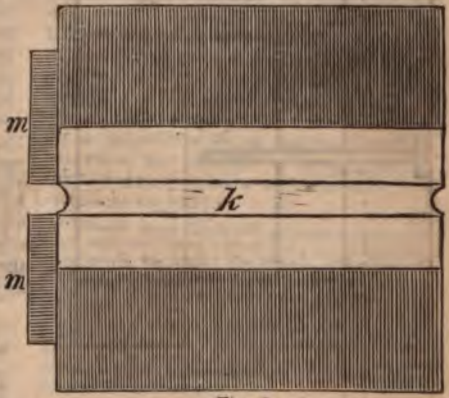
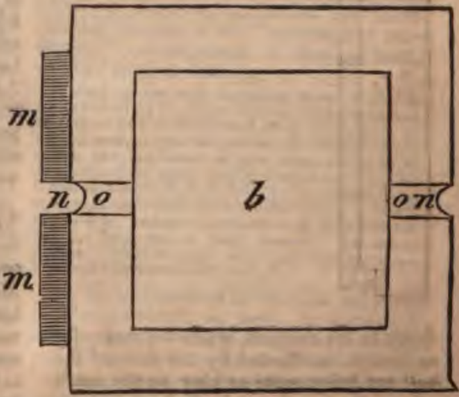
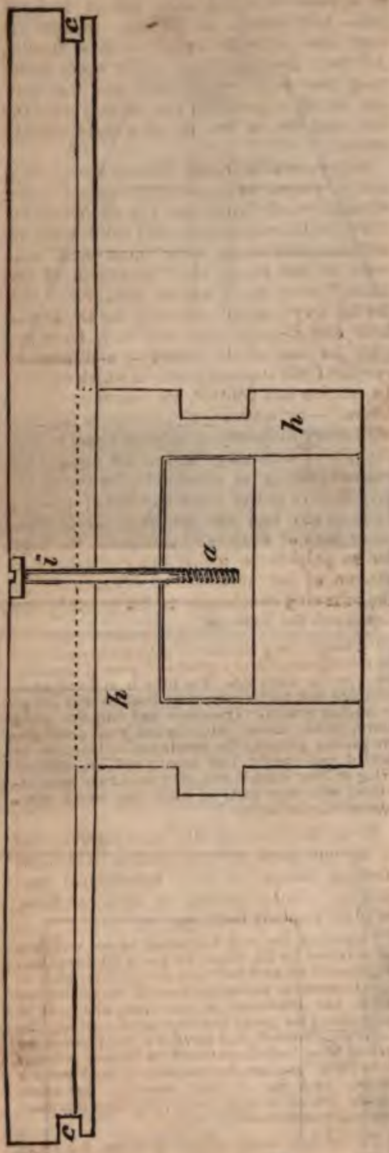


Fig. 5.



sleeper. This section also represents a notch cc at each end of the rail, into which the arm of the bolt, shown at fig. 6, enters, and holds the end of the rail

Fig. 3.



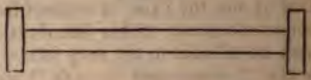
down to the sleepers, while the means for expansion is afforded by the arm of the bolt not being quite so long as the notch *in the rail, nor* the end of the rail quite *touching the body of the* bolt.

Fig. 4 shows the top of a sleeper with the groove *k* in it, in which the rail is fixed, and also the sides of the sleeper in its pyramidial form, with its projecting tongue *m m*, which enters the diagonal groove *l*, in the end of the sleeper placed next to it, as shown in fig. 1.

Fig. 5 represents the bottom of a sleeper with a hollow *b*, in which is fixed a piece of wood, into which the screw *i*, shown at fig. 3, enters, and draws the rail in the middle tightly down upon the sleeper. Fig. 5 also represents the projecting tongue *mm*, with grooves *nn* at each end, which enclose the bolt, fig. 6, and notches *oo* for the bottom arm of the bolt to slide into, flush with the bottom of the sleepers.

Fig. 6 represents the bolt which secures the ends of the rail to the sleepers.

Fig. 6.



The patentee remarks, that "as the rail has a bearing its entire length, it may be made of cast-iron, which will effect a saving of about one-third in the cost of the rail; and as it will be cast to the shape required, there will be scarcely any expense in fitting."

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MR. HERAPATH'S RAILWAY PAPERS.

Sir,—Your correspondent, Mr. Herapath, is undoubtedly one of the happiest of men, as far as regards thorough-going friends. Whenever he is attacked, it costs *him* no trouble to repel the assailant, but some "Anti-H.," "Anti-Carper," or "Philo-Anti-H.," is sure to rush to the rescue. Happy Mr. Herapath, to be in possession of such friends; but happier still, they did not make matters all the worse for him by their interference!

Look, for instance, at the last of them, "Philo-Anti-H.," who draws attention to the late exposures of Mr. H.'s misrepresentations in the pages of the *Mechanics' Magazine*, by way of trumpeting forth his *unimpeached* "character!" This worthy defender of a reputation, whose owner does not think it worth his while to take care of it, calls for "the cases of intentional and prejudicial misrepresentation on the part of Mr. Herapath, with the proofs," in order that he may answer them within a fortnight, and "exhibit H. and his aspersions in their true colours." This challenge seems especially directed to the aforesaid "H.," but, as that correspondent has, to use an Hibernicism, accepted it before it was offered, I venture to suppose that he will not trouble himself to pick any more holes in Mr. Herapath's "beautiful armour," until those it already exhibits are patched up. In plain words, Mr. Editor, and in the name of common sense, what can this "Philo-Anti-H." mean by calling for *cases and proofs of misrepresentation*, when plenty of "cases and proofs" are contained in the two numbers of the *Mechanics' Magazine preceding* that in which his letter is printed? It might at first appear, as his precious epistle has no date, that it was written before H.'s communications containing the "cases and proofs" had been published; but that this is not the case, is evident from the commencement of his lucubration, in which he alludes to the *very letters in which the "cases and proofs" were given!!* What can be the meaning of calling for the production of a thing which you hold in your hand, it is not easy to divine.

If "Philo-Anti-H." is still as determined as ever to support Mr. Herapath's "unimpeached character," let me advise him not to wait for further "charges," but to apply himself at once to the refutation of the very broad and definite ones contained in the *Mechanics' Magazine*, No. 641, pages 133 and 134, and No. 642, pages 167 and 168, in two letters signed "H." Let him answer *them* first, and then—"we shall see what we shall see."

And I am, Sir,
Your obedient servant,
MISO-PHILO-ANTI-H.

THE ALMANACS FOR 1836.

The great improvement which has taken place in the character of this useful class of annuals, may be said for the present, or, more properly, coming year, to be rather sustained than advanced; there seems, in regard to them, to be something like a halt in the march. The *Stationers' Company* still maintain that position in the van from which they were some time ago so nearly ousted by that younger scion of monopoly, the *Useful Knowledge Society*; but they look as if they were about to drop into a sound corporation nap after their hard struggle; or, if we may so express ourselves with respect to such *paper* belligerents, as if they thought it high time to repose awhile on their laurels. All their almanacks are twenty times better than they were twenty years ago, but they are not all so good this year as they were the last, and one or two are of a much inferior stamp.

Our venerable friend, *Francis Moore, Physician*, plays, as usual, the mouth-piece, through which issues the *Vox Stellarum* for 1836, to the wonderment and edification of millions; and but for some "auld warld" conceits he has about the "dominion of the moon," over his "ancles, toes, &c.," and for his very marked partiality for the Sternhold and Hopkins vein in poetry, he might pass for one of the youngest and freshest spirits of the stalwart times in which we live. In religion and politics, for example, who so liberal?—or in astronomy, who more familiar with every discovery of modern times? Although of antiquity, he has no antiquated notions (saving as aforesaid); he is the representative not of yesterday but of to-day; he is an old *boy*, and no joke. From what other man of Francis's years could we hope for so palpable a hit at the much-boasted wisdom of our ancestors as is contained in the following conclusion to his monthly observations for 1836:—

> "Though many clouds still skirt the horizon, you may safely anticipate a great and general improvement among mankind. The time is at hand when such old and big creatures as Nations will not go in leading-strings. Ignorance and folly are going down, down, down; integrity and good principles are gaining ground; the people are no longer to be tickled and caught like trout; and he, whether Whig or Tory matters not, will soon have most influence who does most to make the world wise, contented, and happy."

Or in the following still more forcible, and to all our hard-working readers still more cheering passage of his "astrological predictions"—which passage of them, at least, we place implicit faith in.

> "Mankind are now beginning to see that it is not ordained by the Great Author of all things that they should for ever toil from morn to eve, and, in a great measure, for the purpose of supporting the selfish and intolerant of one class, and that of maintaining the proud overbearing of another. Be it also remembered, that there is a woe pronounced against those '*who laden men with burdens grievous to be borne, and yet they themselves touch not the burdens with one of their fingers.*' Let even-handed justice be dealt out to all; then murmurings and discontents will cease."

To the astronomical information for 1836 in Moore—which, as usual, is unrivalled among the popular Ephemerides for accuracy and fulness—there is annexed the following "brief postscript concerning comets," which considered as a postscript to all that has been written during the past year concerning comets, will be found to bear the customary character of such after-thoughts, namely, of being more germane to the matter than much of the preceding text.

> "At page 41 and 42 of my last Almanac, I gave my readers a probable account of the appearance of *Halley's Comet*, from August 7th onwards, founded on the application of the principles of gravitation to former well-ascertained facts relative to this celebrated wandering star. On the 5th of August it was seen at Rome, and again and again, as before this time all know, in England, Ireland, France, Germany, and elsewhere. And wonderful is it to relate, except to those who are aware that the minutest particles obey the law of gravity, that this curious filmy body, though first appearing through a telescope like a little cloud of smoke, came, as astronomers had computed, *true to its time*, in right ascension, and not differing a degree in declination! Surely this will stimulate even the youngest of my readers to study astronomy as well as astrology. For the astrological history of comets, I must refer you to Edlyn, Gadbury, and others. But let me invite you to inquiries still higher. You know that the great Hugghens taught that the planetary worlds are inhabited; and so, most probably, are many of the comets. Now if we believe, as is natural, that the celestial system is the most populous possible, we must suppose it to contain as many moving bodies as can possibly describe their orbits without confusion, interference, and disorder. Be it then known and received as a demonstrable truth, that eccentric ellipses, such as the comets move in, supply uninterfering orbits in infinitely greater abundance than circles do; and then you will see why the Creator has peopled the heavens with such legions of comets, and why the orbits of the planets deviate so little from the plane of the ecliptic. Now the known planets are only *eleven;* whereas, besides the multitudes that must necessarily escape observation, *more* than *seven hundred* COMETS are enumerated in the catalogues. The comet of 1770, by getting entangled among the satellites of Jupiter, was completely drawn out of its orbit by that planet, and thus forced into a larger ellipse; and yet, as Sir John Herschell affirms, the motions of the satellites of that planet suffered not the least perceptible derangement by this singular occurrence. How small then, comparatively, must be the mass of that comet! Seneca relates, that sixty years before Christ, a large comet was discovered near the sun during a total eclipse of that luminary; look out then carefully during the great eclipse of next May, especially in the north of England; for you know not but the sight of a *comet* as well as the planets may reward you for your pains."

White's Ephemeris, by Dr. Gregory, is another of the Company's year-books, which stands out in bold relief from the general mass, and is only not so popular as Moore, because it is so much more difficult of comprehension—that is to say, so much more profound and scholar-like. Among the improvements in this *Ephemeris*, there is a very valuable one which relates to the *Right Ascensions* of the old planets; they are now given for each day at noon correct to seconds of time. "The *hours* of right ascension are given at the top of each respective column, and again as often as the hour changes; the minutes and seconds for each day follow in succession. The minutes and seconds for the day in which the hour changes may, of course, be taken as a *mean or proportion between* these for the preceding and succeeding days. The *Appendix*, which, since the abolition of the stamp-duty on almanacs, has been added to White's, consists this year of a very elaborate set of "Theorems and Tables for Computing the Orbit of a Comet," extracted from Dr. Bowditch's translation of the *Mecanique Celeste*—a work (the translation we mean) which does everlasting honour not only to the science, but to the typography of the United States.

Lady Di. appears to have been to France since last year, and to have come back by no means improved in her manners. Her *first* page, "for the amusement and instruction of the fair sex," is all about *Births, Birth-days, Birth-places*, and the Mean Expectation of life at *Birth* in each county of England, which Expectation of Life her ladyship never condescends to speak of but as *la vie moyenne*. The nursery statistics we might pass over as being passably appropriate to a work devoted to the fair sex, but the piebald phraseology is, "vile affectations mark ye." We expected to have met with some more such fruits of travel in that portion of her ladyship's diary devoted to enigmas and conundrums; but here it would seem the native supply of "motley" is so ample as to defy all foreign embellishment. Her ladyship's chamberlain (*vulgo*, Editor) states, that "though his attachment to Madam *Mathesis* remains undiminished, he shall always preserve a fair field in what those who are enamoured with either of the interesting(!!!) damsels," ycleped *Charade* and *Rebus*, "may exhibit their respective excellencies as their utmost variety." We are truly sorry for his mistress's sake that he should be so excessively complaisant. We would give not only a fair but a wide field to "excellencies" of any sort; but Mesdames Charade and Rebus have never within our recollection done any thing but disgrace the respectable company in which they were allowed to mix at Lady Di.'s parties, by the lowness of their language, and the Rag-fair style of their attire. Only look, for example, at this picture and on that. This shows you one of the word-torturing tribe, crying his fantastic wares in a learned assembly, in such execrable doggerel as the following:—

> "Here are *manes* for old horses whose necks are gone bare,
> And *pen-knives* to cut off superfluous hair;
> Here are fam'd *Plantagenet* and praiseworthy *Dante*,
> No doubt they'll supply us with all that we want (y),
> For good rhymes and good government should not be scanty."
>
> &c. &c.

Who (not knowing Lady Di. and the queer company she keeps) could expect, on turning the same leaf which contains such trash as the above, to meet with so excellent though brief a notice on the art of instructing the deaf and dumb, as that which follows:—

> "The art of instructing the deaf and dumb originated in Spain, where also the double-handed manual alphabets were invented. The subjects are, indeed, so intimately connected, that it would be useless to attempt to keep the consideration of them entirely separate. It is a vulgar mistake to assign a French origin to those useful arts. The Abbé de l'Epée could well afford to spare the honour of the original discovery, if the assertion of an eloquent writer in the *Edinburgh Review* be true, that 'he is not the first discoverer of an art who first says the thing; but he who says it *so long, and so loud, and so clearly*, that he compels mankind to hear him.' Of the manual alphabets the Abbé certainly was not the inventor; and the impression that he was such, may, perhaps, have arisen from the circumstance that his tombstone in the cemetery of Père la Chaise, at Paris, bears the figure of an open hand.
>
> "Father Ponce, a Benedictine monk of the monastery of Ona, in Spain, who died in 1584, appears to have been the first who exercised the art of instructing this unfortunate class of beings; but we are unacquainted with his method. Don Juan Paolo Bonnet published, in 1620, a book in which he delivered the principles by which he had been guided in the education of the constable of Castille, who had become deaf at four years of age, but who, under Bonnet's instruction, learned to speak his native language with much distinctness. Bonnet was emulated—it is not clear that we should say *imitated*—by Digby, Wallace, and Burnet, in England; Ramirez, of Cortono; Petro de Castro, of Mantua; Conrad Amundo, a Swiss physician, practising in Holland; Van Helmont, and probably many others. The later most successful attempts of Braidwood and Kinniburgh, deserve the warmest eulogy."

Of the same redeeming stamp with the preceding extract are the "Answers to the Mathematical Questions in the last Diary;" which are generally excellent, and not unfrequently distinguished by great originality. Among the contributors to this department, Mr. Woolhouse, the Head Assistant at the *Nautical Almanac* Office, occupies by far the highest place; Mr. W. is also the author of a valuable paper, "On the Summation of Infinite Series by Decompositions of Factors," which, with a continuation of the Horæ Geometricæ, by Mr. T. S. Davies, and a Synopsis of Spherical Geometry, by the same, make up the Appendix to Lady Di. for the ensuing year.

The *Gentleman's Diary* has relapsed this year a little into enigmatology, but only a very little; and deserves, in all other respects, our hearty commendation. Several pages of extremely well-selected "Scientific Notices" are followed by five times as many of contributions to mathematical science, rivalled only in excellence and variety by those of the sister Diary. We are tempted to make the following extract from the latter portion, less by way of specimen than for the sake of the important bearing which it has on practical mechanics:—

"(6) QUEST. 1340, by Mr. MARRAT.

"Determine the effective force of the screw, or what part of the power, obtained by theory, ought to be allowed for friction.

"Answered by Mr. MARRAT, the Proposer.

"The following theorem for this purpose is given by Venturolli, in his Mechanics, viz.

$P = Q \cdot \frac{b}{a} \cdot \frac{h + 2 f \pi b}{2 \pi b - f h}$; where P is the power acting at the end of the lever whose length is a, the radius of the screw $= b$, the step of the screw $= h$, $\pi = 3 \cdot 1416$, f the friction, and Q the weight raised, or the force of pressure. By the above theorem we obtain $f = \frac{2 a \pi b P - Q b h}{2 b^2 \pi Q + a h P}$ for the quantity of friction.

"From a series of experiments which I made some time ago, with a pair of beautifully-made iron screws, in each of which P was 30lbs., $a = 3\frac{1}{2}$ inches, $b = \frac{1}{2}$ an inch, and $h = \frac{1}{10}$ of an inch, I found, in every instance, that the effect produced was only $\frac{1}{5}$ of that given by the theory, or that the friction destroys $\frac{4}{5}$ of the effect as calculated by the theory. Now, if we substitute the dimensions of our screw, the power being 30lbs. and $Q = 1320$lbs. as found by the theory, we find, from the above theorem, $f = \frac{1}{8}$. Hence it appears that the result obtained from theory is exceedingly erroneous. Mr. B. Bevan had arrived by experiment at the same result."

(To be continued.)

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NOTES AND NOTICES.

Extension of the Term of a Patent under the late Patent Law Amendment Act, Dec. 15, 1835.—The Lords of the Judicial Committee of his Majesty's Most Hon. Privy Council sat to-day in the Council Chamber, to hear the petition for the extension of Erard's patent for pianofortes. The Lords present were—Lord Lyndhurst, Lord Brougham, Mr. Baron Parke, and the Chief Judge in Bankruptcy. Signor Scappa, and other musical professors; the clerk and the foreman of Mr. Erard, were examined by counsel before their Lordships. Lord Lyndhurst, on the part of the Lords present, stated that a sufficient case had been made out to induce their Lordships to recommend to his Majesty to extend the period of the first patent of 1821 and 1822, for England, Scotland, and Ireland, for seven years; but their Lordships did not consider there were sufficient grounds for extending the term of the second patent of 1825.

Another Proof of the Inferiority of English Artisans.—A subject of general conversation among the upper classes at Paris at this moment is a splendid service of plate, for thirty persons, just arrived at Paris, belonging to the Earl of Pembroke, made by Storr and Mortimer, and which a privileged few have been permitted to visit, at his lordship's residence, at the request of the makers. Its weight is 830 lbs., French, and it costs upwards of

700,000 f.: one piece, a candelabrum, is estimated at 40,000 f. Its manufacture occupied the house three years. Nothing can exceed the beauty and delicacy of the chasing, and the engraving of his lordship's arms displays the most skilful workmanship. The dessert service is of silver gilt.—*Galignani's Messenger.*

A Hand Water-Engine.—A hand water-engine, on an entirely new principle, has lately been invented by Mr. Read, the patentee of the best of all our garden syringes. This new invention is very little larger than the syringe, but it has a tube added to it, which, being inserted in a pot or bucket full of water, gives the instrument all the powers of a garden-engine, with less than half the exertion required for working the latter machine. The power gained is by the condensation of air in a tube or barrel, parallel to that in which the piston works; so that the invention might not unjustly be called Read's double-barrelled syringe. The whole instrument, including the length of the handle, and the tube, which can be screwed on and off, is only three feet long, and the barrel part is but half that length. The price is only 50*s.* We have seen it at work, and consider that, for all ordinary purposes, it will supersede both the garden-syringe and the garden-engine.—*Gardener's Magazine.*

Irish and Virginian Tobacco.—Professor Davy, of the Royal Dublin Society, has made some experiments on the comparative value of Irish and Virginian tobacco, from which he has been led to conclude, that one pound of good Virginian tobacco, is equal to about two pounds and one-third of Irish tobacco. Manufacturers are said to consider one pound of Virginian as equal to about two pounds of Irish tobacco. Hence, there seems to be a pretty near coincidence between the results obtained by manufacturers and those derived from a chemical examination. He also ascertained that the roots of the Irish tobacco contain about four or five parts in the hundred of necotin, or the peculiar principle in tobacco.

Fossil Tree.—In the quarry from which stones are at present being taken for the new church erecting at the Miltoun of Balgonie, was lately discovered a large fossil tree. It is lying nearly horizontal, and is as yet attached by about two-thirds of its circumference to the sandstone. It is about fifteen inches in diameter, and about seven feet of it are at present visible. As it tapers slowly to the outer end, the portion still undiscovered is probably considerable. It is wholly composed of white sandstone similar to that in which it is imbedded. This quarry is remarkably rich in vegetable impressions. Casts or marks of palm trees are to be found in great beauty and abundance.—*Sunderland Herald.*

The Moon Inhabited.—Professor Gruithausen, of Munich, has publicly declared that he has discovered irrefragable proofs that the moon is inhabited like the earth. All Europe has answered by railleries the declaration of the Bavarian astronomer, but his firmness has been no more shaken than that of Christopher Columbus was, when he announced the existence of a new world. The German journals have published the observations of Professor Gruithausen, combined with those of his learned brother, the astronomer Schroeler. Their common conclusions are, 1st, that vegetation upon the surface of the moon extends to the 55th degree of latitude south, and to the 65th degree of latitude north; 2dly, that from the 50th degree of latitude north to the 47th degree of latitude south, may be perceived evident traces of the abode of animated beings; 3dly, that some signs of the existence of lunar inhabitants are sufficiently apparent to enable a person to distinguish great roads traced in several directions, and particularly a colossal building situated nearly under the equator of the planet. The *ensemble* presents the aspect of a large town; near to which may be distinguished a building, perfectly resembling that which we call a redoubt, or hornwork.—[Query—Are there any mines or railways?—Ed. *Mining Journal.*]

Centrifugal Force.—At Little Green Logwood mill, Middleton, near Manchester, occupied by Mr. George Wolstencroft, there is a grindstone used for grinding the rasping knives for cutting logwood, upwards of 15 feet in circumference, and 11 inches and upwards thick. On the 24th ult. as Mr. John Wolstencroft, the son of the occupier, and another young man were grinding the knives at the stone, the young man had screwed the machine in which the knife is held for grinding rather too tight; this being observed by Mr. John, who also saw that the stone was revolving at a tremendous speed, he desired the young man to be cautious. No sooner had the words dropped from his lips, than the stone broke in several pieces, one of which, weighing not less than 6 or 7 cwt., forced its way through a wall a brick and a half thick, and drove a large quantity of the bricks upwards of 20 yards from the wall.—[A similar accident occurred some years ago. See vol. xviii. p. 32.]

New Hydrostatic Engine.—We have had an opportunity of examining the recent discovery made by the Rev. J. T. Porter, of the Close of this city, which he had named an hydrostatic-engine, and which, when brought to perfection, will, in all probability, vie with the astonishing power of steam. The principle upon which the engine acts is the well-known law of nature, "the pressure of fluids." The construction of the apparatus is simple, consisting of four cylinders, two of which act as pumps, the other two as working cylinders, each of them having proper pistons. The double-acting power (of the model) is put in motion by only 25 ounces of water, assisted by the lever. Some idea may be formed of the force of the pressure, when we say that with the stroke of one of the cylinders of the piston, an ash bough, an inch and a half in diameter, was broken with the greatest ease. The rev. gentleman is very sanguine as to the ultimate success of his discovery, and affirms that a ship, laden with the usual freight, may take a trip to the East Indies and back, the engine requiring for its total supply not more than a half hogshead of spring-water.—*Salisbury Journal.*

Communications received from Mr. Henderson—△—Iver M'Iver—An Old Subscriber—⊕—Mr. Lush—Mr. Birt—A Lover of Mechanics.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price 6*d.* Also, the volume complete, in boards, price 9*s.* 6*d.*

☞ Patents taken out with economy and despatch; Specifications prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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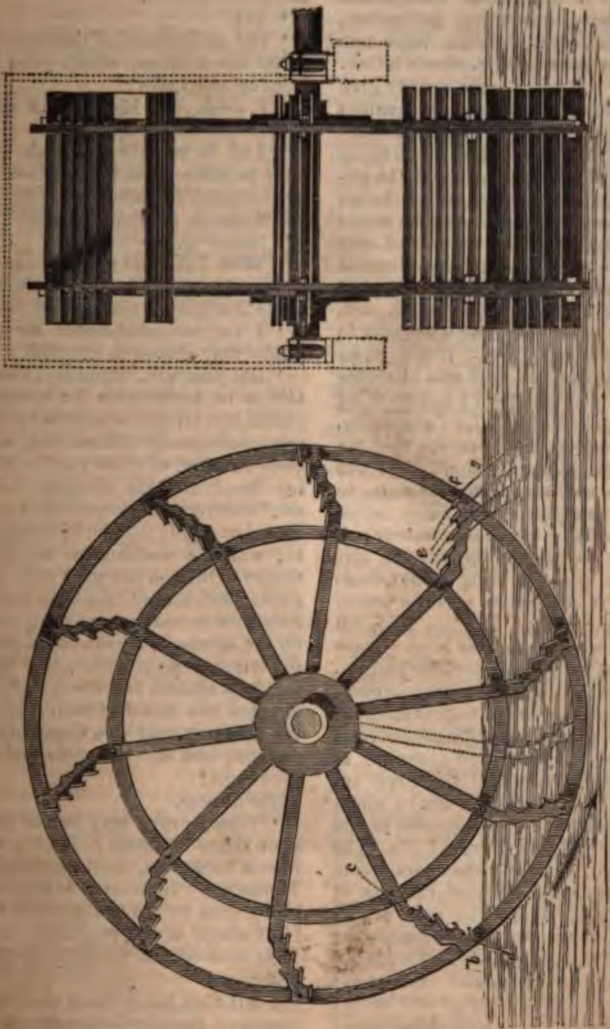
MR. ELIJAH GALLOWAY'S NEW PATENT PADDLE-WHEEL.



MR. ELIJAH GALLOWAY'S NEW PATENT PADDLE-WHEEL.

Mr. Elijah Galloway, the inventor of the paddle-wheel commonly known by the name of *Morgan's Wheel*, has taken out a patent for a new wheel, which, in a circular to the proprietors of steam-vessels, he says is free from the "intricate mechanism" of his former wheel, and "for simplicity, durability, and power, *must* be regarded as the most important improvement upon paddle-wheels hitherto effected." We can more readily give our assent to the first of these propositions than to the second. The "intricate mechanism" of Morgan's wheel is certainly its *weak point;* though perhaps the objection would have come with a better grace from any other person in the world than from him who invented it, and who sold it for a valuable consideration to the gentleman whose name it has acquired, from his long, persevering, and, as yet, but poorly-requited exertions to bring it into general use. But why we "*must*" needs regard this new offspring of Mr. Galloway's ingenuity as exceeding all that has gone before it for "*simplicity, durability,* and *power*"—except that we have his own modest authority for the fact—we cannot see. The wheel is, in reality, no simpler than many other wheels; whether it is more durable or not, neither Mr. Galloway nor any one else can yet tell (for the thing is but three months old); and of its superior power there are no proofs. We are told, indeed, that wheels on this plan "have been fitted to the Rose (Sheerness) steam-packet and the Monarch steam-vessel, and that in each case the improvement of the vessel in speed, reduction of swell and vibration, is so decisive and apparent, as to have fully established the great superiority of the invention." But by whom is all this certified? The captains of the vessels? No. The engineers? No. The owners? No. Some passengers, then, who have witnessed the performances of the new wheels? No. The only person who vouches for the vast improvement effected by Mr. E. Galloway's new wheels, is Mr. E. Galloway himself! We do not imagine the world in general will be disposed to pay much heed to such testimony as this; but, to prevent any mistakes as to its real value, we must take leave to cross-*examine the witness* a little.

'*You say, Mr. Galloway,* that your new wheels have been fitted to the Monarch?

'Yes.

'And that there has been a decided improvement in speed, reduction of swell, and so forth?

'Yes.

'And the Monarch you speak of is *the* Monarch steamer?

'Yes.

'The noble vessel of that name of some 1,000 tons burthen, which plies between London and Leith?

'I mean the Monarch to which my paddle-wheels are applied.

'And is not the Monarch to which your paddle-wheels are applied, and the vessel which is known to all the world as *the* Monarch, one and the same?

'N—n—o.

'What! Do you mean to say that you did not intend the public should conclude that they were one and the same?

'I am not answerable for what the public may choose to conclude.

'But you will, probably, allow yourself to be answerable for betraying the public into false conclusions by deceptive representations? When you speak, in your circular, of your paddle-wheels being fitted to "*the* Monarch steam-vessel," did you not expect that every one would conclude that the Monarch referred to, was the well-known vessel of that name? Did you not *wish* such to be the general inference? And did you not *calculate* on its making a strong impression on the minds of steam-vessel proprietors in favour of your wheel, that no sooner was it published to the world, than it was adopted in a vessel of such magnitude as the Monarch, and by a Company of such standing and experience as that to which it belongs?

No answer.

'What, pray, may be the tonnage of your sham Monarch? Is it a tenth, or even a twentieth, of the size of the real Monarch? Is it any thing better, in short, than an old tow-boat of the humblest class, which you have fitted with your new wheels for the purpose of experiment?

'All that has nothing to do with the merits of the wheels themselves.

'Only this, Mr. Galloway, that it shows, that the increase of "speed" which you claim credit for, is not an increase in the rate of speed of the vessel known to all the world as *the* Monarch, and other vessels of that first-rate class—but an increase in the speed of a vessel of which we know nothing, and most of us never heard before. It may, for aught that appears, be an increase in a snail's pace.

'But the *Rose* is a well-known vessel.

'Yes, well known for being one of the slowest steamers on the River; to improve the speed of such a vessel as that is no great boast?

'It matters nothing what the former speed may have been. If a very slow vessel has had her speed increased by substituting my new wheels for the common wheel, so must also a very fast one—that is, proportionally.

'There you are right; but before we can allow your new wheels the credit of increasing the speed of the Rose, we must be certain that all other circumstances remain the same with respect to the vessel; as, for example, that the new wheels occupy precisely the same situation as the old, neither farther forwards nor farther aft—that no alteration whatever has taken place in the weight or position of the engines—that the vessel's bottom remains as before, &c.?

'I can remove all doubts on these points. The wheels—

'Perhaps you can, Mr. Galloway, and quite as satisfactory as you have removed other doubts belonging to the case; but as we cannot consider you a competent witness in your own cause—standing alone, especially, as you do—we shall not trouble you further for the present. When you can bring forward the Captain of the Rose, or any of his people, to speak in your behalf, we shall be glad to hear them.'

Now, then, that we have done with our cross-examination of Mr. Galloway as to the performances of his wheel, we shall leave him to describe in his own way the mode of its construction and operation. The prefixed figures represent a side and end view of the wheel; and the following is the description of it given in Mr. Galloway's circular:—

> "The framework of the wheel resembles the common paddle-wheel; the improvement consisting in the form and arrangement of the floats. Each of these consists of a number of parallel flat bars (resembling a Venetian blind), firmly secured to the arms of the wheel, which are constructed with steps to receive them. Their respective positions will be seen by reference to the annexed engraving, where ab represent a paddle entering the water. It will be there seen that the dotted line cd (which is the cycloidal curve generated by the point a of the paddle, whilst the vessel is in motion) passes through the centre of each of these bars, and that the *lowest bar only* encounters a resistance at entering, the other bars following in its wake or path. The series of bars, therefore, enter the water with as little loss from oblique action (to which the common paddle is liable to a considerable extent), as if it were a solid float entering *edgewise*. All concussion or vibration is got rid of, and the paddle only commences to act on the water when it is completely immersed; it then gradually reaches the point of deepest immersion, where the bars present their flat surfaces at right angles to the line of the vessel's motion; and their propelling resistance, therefore, corresponds with that of one uniform surface equal to the sum of their areas. The paddles then gradually rise out of the water, and quit it in the position shown at ef. Here the cycloidal curve would not be the direction in which a point would pass through the water; for by the retrogression of the paddle the fluid acquires a backward motion, whereas the paddle enters it whilst in a state of rest. The curve, therefore, which would be described through the moving fluid, approximates very nearly to the curves $gggg$. Hence the bars of the paddles traverse this curve, and leave the water *edgewise*, without lifting more than a slight adhering spray."

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THE BRITISH IRON MARKET.

We extract the following valuable and interesting information on this head from a letter dated "London, Oct. 9, 1835," addressed to the *American Railroad Journal* by Mr. Gerard Ralston, of the house of Messrs. A. and G. Ralston, of Philadelphia, who has been for some time in this country engaged in making purchases for the American market. Mr. G. Ralston, at the close of the same letter, requests the attention of the American scientific public to the doubts thrown by some correspondents of the *London Mechanics' Magazine* (Fanqui and Mr. Thorold), on the reported performances of the Lexington steam-boat, in order that the same may be forthwith removed and the "character of his countrymen vindicated." "People," he says, "in this country (England) think we are rather disposed to 'shoot with the long bow,' and it is desirable to correct this opinion so injurious to our national character." We sincerely wish we could plead "not guilty" to this national impeachment; and beg to assure Mr. Ralston, that few things could give us more pleasure than to be aiding in the smallest degree in setting the *archery* of his countrymen in a fairer light before the world. Should we meet in the American journals with any reply on the subject of the Lexington, it shall be immediately transferred to our columns.—ED. M. M.

"As your readers are much interested in railway iron, I will communicate the most recent information on the subject of common iron, the demand for which, of course, regulates the price of the other. On the 25th of August last, the iron-masters of Wales had a meeting at Cardiff, and ascertained, from mutual inquiries, that there had been a diminution of the stock of iron (Welch only), since the commencement of this year up to that time, of the large quantity of 45,000 tons, notwithstanding the manufacture was going on more extensively than usual. This fact induced them to advance the price of No. 2 bars, from 5*l*. 10*s*. per ton to 6*l*. per ton. Since then orders have come in on the most extensive scale, and, on the 9th of September, ult., they were induced to advance the price to 6*l*. 10*s*. per ton; and again, on the 30th of September, ult., they announced a further rise of 10*s*. per ton, making 7*l*. per ton free on board at Cardiff and Newport. The Staffordshire, Shropshire, and other midland county iron-masters, have advanced in an equal proportion. Some of the largest iron-masters have recently informed me, that so great is the demand, that all the establishments in Wales have already orders for execution to keep them busy during the remainder of this year; and as orders continue to come in from all quarters, principally from the Mediterranean, Holland, Germany, the United States, and also for exportation to the East Indies and China, whilst the home demand, for railway and other purposes, is for an extraordinary amount, there is every prospect of another advance of 10*s*. per ton, before the expiration of many weeks. I am told by experienced persons, that the demand now is greater for iron than was ever before known, excepting during the bubble year, 1825, when the demand was altogether of a speculative character; now the demand appears to be, exclusively and *bonâ fide*, for immediate consumption.

"To show you how this affects railway iron, I will communicate a few particulars of my own transactions, within a few months. I contracted, on the last of March last, on behalf *of a Railway Company*, in the State of *New York, for about* 1,000 tons of iron, and paid 7*l*. 4*s*. per ton for edge-rail (being No 3 iron, and when manufactured into rails ought to be 40*s*. per ton higher than common No. 2 bars). Early in May I contracted, in behalf of a New Jersey Company, for about 1,600 tons of edge-rails, at 7*l*. 6*s*. per ton. Last month, September, after iron had advanced 1*l*. per ton, I made a contract for 2,000 tons of edge-rails, for a Delaware Company, at 8*l*. 5*s*. per ton; and a few days after, for 1,300 tons of edge-rails, for a Pennsylvania Company, at 8*l*. per ton, but the pattern is less difficult to roll than that for the Delaware Company. I have also contracted for several thousand tons of chairs, pins, wedges, flat bars, &c., but it is unnecessary to give their prices, because they are regulated also by the price of No. 2 common bars.

"To enable your readers to judge what would be the price of to-day, if I were now in the market, I should think the March, May, and September contracts could not be done under 8*l*. 15*s*. per ton; and that for the Delaware Company (being difficult to manufacture) not under 9*l*. per ton. From this you will see, that those Companies who sent their orders early have reason to congratulate themselves, that they have been executed before the great advance in iron was effected. As the great railway from London to Liverpool (220 miles) may want some 20,000 or 25,000 tons of very heavy rails (60lbs. per yard) in the spring, and as the Southampton (75 miles), Western (120 miles), and many other minor railways, will want large quantities during the summer of next year, I should not be surprised if edge-rails should be advanced to 11*l*. per ton by the 1st of May next, and iron will continue high during the whole of next year. I may be mistaken, but having had some experience in this trade, from having bought and exported to the United States (my brother and myself) upwards of 40,000 tons of railway iron, within a few years, I think I have some acquaintance with the iron-market of this country. If the French Government should imitate the wise example of our American Government, and allow railway iron to be imported free of duty, as it is now reported to be their intention, I have no doubt this will give an impetus to the construction of railroads in that country, which will still further advance the price of iron. All countries throughout the world must get their railway iron in England, where it is manufactured with such economy, such rapidity,* and so perfectly, that it is useless to pretend to compete with this branch of industry."

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* "I once had 1,800 tons of edge-rails, of 40lbs. per yard, manufactured and shipped within four months from the time the order left America. It was for the State of Pennsylvania; the order left Philadelphia on the 6th of May, and *all* the iron was on ship-board, on its way to Philadelphia, before the 1st of September following. This extraordinary dispatch was accomplished by one house

REPORT OF THE SELECT COMMITTEE OF THE HOUSE OF COMMONS ON ACCIDENTS IN MINES.

Your Committee have called before them witnesses connected with all the great mining districts of the kingdom. They have also examined plans, diagrams, and a great variety of lamps. To the evidence which accompanies this Report, your Committee solicit the attention of the House. Your Committee have had ample opportunity of multiplying proofs of the calamities which have occurred in the mines of this kingdom by sudden explosions of fire-damp, foul air, or sulphur, all which terms are locally applied to carburetted hydrogen gas, so copiously evolved in many of those mines. Few collieries are entirely free from fire-damp, but in many the quantity emitted is so large, that in spite of skill and unremitting attention, the risk is constant and imminent. Having alluded to the *nature and cause* of the accidents which have taken place, your Committee proceed to report upon the extent of the mischief which has resulted to property and human life. The amount of damage sustained by these explosions is described by several witnesses to have been great, and, when estimated in connexion with losses arising from interrupted trade, enormous; it is, nevertheless, rather with reference to the cause and interests of humanity than in a pecuniary point of view that this injury has assumed its just importance. Your Committee have failed in obtaining accurate information as to the number of lives lost within a limited period. Many documents, however, have been produced, from which much correct information on this portion of their inquiry has been derived. In the course of the last session, certain returns were made by the clerks of the peace of inquests held by the coroners on parties who had met with untimely deaths in the mines of England and Wales. These returns were very defective: from some counties the required information could not be obtained; in others, the nature of the accidents reported was not mentioned. They gave a total of 954 persons who had perished during the last twenty-five years. The following is a summary:—

Chester	lives lost	7	fire-damp and choke-damp.
Cumberland	ditto	140	ditto .... ditto.
Derby	ditto	19	ditto .... ditto.
Gloucester	ditto	3	ditto .... ditto.
Monmouth	ditto	3	ditto .... ditto.
Nottingham	ditto	18	ditto .... ditto.
Salop	ditto	89	ditto .... ditto.
Somerset	ditto	1	ditto .... ditto.
Stafford, one district	ditto	104	ditto .... ditto.
Warwick	ditto	3	ditto .... ditto.
York, North Riding	ditto	29	ditto .... ditto.
York, West Riding	ditto	23	choke-damp.
Ditto	ditto	93	fire-damp.
Ditto	ditto	230	other accidents not specified.
Brecon	ditto	15	ditto.
Ditto	ditto	3	explosions.
Flint	ditto	39	choke-damp and fire-damp.
Lancashire (no returns for several districts)	ditto	135	ditto .... ditto.
		954	

Many of the counties and divisions of counties, from which no returns have been received, are those wherein your Committee have reason to belive catastrophes have occurred, which would have materially swelled the catalogue. The counties of Durham and Northumberland, it will be observed, are omitted. As respects these, the most important of all, the exertions of an able and indefatigable collector have supplied the deficiency. Mr. John Sykes, of Newcastle, in his published "Local Records" of those counties, presented the public with a list of accidents from an early period. The general correctness of that list has been proved; it was revised and amended by Mr. Buddle, who affixed an asterisk opposite the names of the collieries which came under his personal notice at the times named. Those melancholy de-

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in Wales, who had their regular business orders to attend to, besides the execution of this contract. The *whole of France* could not execute this order in four months! But I would not promise equal dispatch now, for all the iron-masters are so busy, and have such an abundance of orders, that much more time than usual must now be allowed to them."

tails are confined to what has happened on the banks of the rivers Tyne and Wear since the year 1710. It appears that in those districts alone,

There perished 1,479 by explosions of fire-damp.
—— 84 by inundations.
—— 37 by other casualties.
1,600 — Total since 1710.

The list as drawn out furnishes an account from 1810 of 1,125 lives lost; this, added to the general returns already alluded to (defective and vastly short of the total as your Committee believe them to be), gives the number of fatal accidents for the last 25 years, 2,070. One striking fact requires to be particularly pointed out. If the year 1816 is assumed as the period when Sir Humphrey Davy's lamp came into use, a term of 18 years since 1816, and a similar term prior to 1816 being taken, it will be seen, that in the 18 years previous to the introduction of the lamp, 447 persons lost their lives in the counties of Durham and Northumberland, whilst in the latter term of 18 years the fatal accidents amounted to 538. To account for this increase, it may be sufficient to observe, that the quantity of coal raised in the said counties has greatly increased; seams of coal, so fiery as to have lain unwrought, have been approached and worked by the aid of the safety-lamp. Many dangerous mines were successfully carried on, though in a most inflammable state, and without injury to the general health of the people employed in them. Add to this the idea entertained, that on the introduction of that lamp the necessity for former precautions and vigilance in great measure ceased.

These facts led your Committee to a serious part of their inquiry. How are these calamities to be prevented for the future? They desire fully to recognise the undoubted rights of property, enterprise, and labour. They acknowledge their conviction, that the public interest has been served by the opening of the more dangerous mines, and the competition their working has created; they do not overlook the anxious care alleged to have been maintained to diminish the attendant risk; but they deem it their duty to state their decided opinion, that the interests of humanity demand consideration, and they would gladly put it to the owners of these mines how far any object of pecuniary interest or personal gain, or even the assumed advantage of public competition, can justify the continued exposure of men and boys in situations where science and mechanical skill have failed in providing any thing like adequate protection. Immediately after their appointment, your Committee received intelligence that a most awful and melancholy catastrophe had taken place at Wallsend Colliery, between Newcastle-on-Tyne and Shields. Having called for a copy of the evidence taken by the coroner, it has been produced, and accompanies this Report. The particulars it contains, extracted in the course of an able and patient investigation, and the further elucidation of the case, as contained in the evidence of Mr. Buddle before your Committee, are of a deeply interesting character, the whole furnishing an example of a most dangerous mine, which, though conducted on principles sanctioned by some of the most eminent colliery viewers and best pitmen, cannot be considered secure from the recurrence of similar calamities. Your Committee refer to the verdict of the jury, and to a document containing the opinions of a highly respectable meeting held in Newcastle, as proofs, that in the judgment of well-informed individuals, no reasonable precaution had been omitted. The melancholy result was, that in an instant 101 men and boys were killed.

Here your Committee would observe, that without any disposition to question the zealous and faithful discharge of their important duties by local coroners and juries, it may be expedient to consider how far it is necessary to provide that at the earliest possible opportunity information of every accident attended with death to a large number of his Majesty's subjects, should be transmitted to the Secretary of State for the Home Department, and that he, or the Chief Justice of England, his Majesty's Coroner, should, at his or their discretion, direct the attendance of some fit and proper person or persons, by them to be appointed, to be present at and assist the said coroner and the jury in their investigations. From such a proceeding, results the most valuable to humanity and science might be obtained; the aim of justice would be still better secured, and to the public (particularly the relations of the deceased) the verdict would be delivered under the best possible recommendation, and with the highest sanction. The presence of carbonic acid gas, or choke-damp, though less sudden and violent in its consequences, has proved a fatal attendant of the miner in innumerable instances, and this in districts where explosions are rare and insignificant. Other noxious gases, varying in kind and combination, are also stated to exist in certain mines, and furnish additional subjects for chemical investigation. Inundations of water have occasionally been very destructive. There still remains a long list of casualties, some of which are wholly beyond human control, inseparably from mining pursuits, and their fatal results are often justly attributed to ignorance, or a wanton neglect of ordinary caution, and a recklessness of danger in defiance of common discretion. Your Committee, strongly impressed with the paramount importance of that part of the question referred to them, which calls upon them to investigate the best method of preventing the recurrence of these calamities, have assiduously and anxiously inquired into the nature and success of the means already adopted. In this part of the inquiry your Committee have had the voluntary and valuable aid of philanthropic and scientific individuals, to whom the community is greatly indebted. The means of prevention may be divided under three heads: 1. Ventilation; 2. Safety-lamps; 3. Maps or plans.

1. Ventilation, by which is meant an adequate supply of atmospherical air, sufficient as an active agent to displace deleterious gases, or so to adulterate those gases, so as to leave them no longer explosive, or, as in the case of carbonic acid gas, no longer fatal to vitality. On ventilation, and the daily unceasing, strict discharge of duty by every person engaged about the mines, from the scientific professional viewer, through all grades, the under-viewer, the wasteman, the overman, the deputy, the lamp-keeper, the pitman, down to the trapper (often a boy too young and thoughtless who manages the air-doors), depends the safety of hundreds of men and boys, from minute to minute; one act of omission of assigned duty, one solitary, momentary neglect may cause the instant destruction of life and property to an indefinite extent.

2. Safety-lamps; by the aid of which the miner is enabled to commence and continue his operations in situations where no naked light could be used, and at other times as a precaution against apprehended sudden changes in the atmosphere which surrounds him.

3. Maps or plans, accurately defining not only the mode of conducting the air-courses, but the entire of the workings pointing out also the position of adjacent abandoned mines, which may have become reservoirs of gas or of water.

The various modes of ventilating mines already in use, as well as those systems which have given place to improved methods, will be found detailed by various witnesses, and their merits so fully canvassed, as to require no comment from your Committee. To enter upon a review of every plan and suggestion would compel your Committee to exceed the reasonable limits of a report. They do not hesitate to express a conviction, that whilst some mines equally foul are naturally freed from large accumulations of gas, by the approximation of the seams of coal to the surface of the earth; others, where the seams lie horizontally, or nearly so, require more shafts, additional opportunities for the injection of pure air and the rejection of foul than are ordinarily afforded. A less parsimonious system in this respect, in the original design of those mines, and in their subsequent working, would have rendered easy otherwise difficult ventilation, and saved many valuable lives. The absolute necessity of greater attention to this point has been fully established.

The practice of placing wooden partitions or brattices in the ventilating shafts is deservedly reprobated; the slightest explosion may remove them: thus the whole system of ventilation is destroyed, and no timely aid can be rendered to the temporarily surviving sufferers. Your Committee have reason to believe that this opinion is generally adopted in the coal-mining districts. To this point they attach an importance, inferior only to the provision of a sufficient number of up-cast and down-cast shafts. They consider that the evidence justifies the suspicion, that the foul and free air-courses are frequently too near to each other, the communications not adequately protected, and that the lengths of air-coursing are excessive, giving opportunities for leakage, interruption, and contamination. The temporary nature of the stoppings, often boards imperfectly united, sometimes mere heaps of small coal, and their frequent derangement, inevitably produce dangerous consequences.

Your Committee have endeavoured to investigate with strict impartiality the merits of the different lamps which have been brought under their notice. In the course of the evidence many varieties will be found described. The invention claimed by the late Sir Humphrey Davy, on principles demonstrated by that able philosopher, may be considered as having essentially served the mining interests of this kingdom, and through them contributed largely to the sources of national as well as individual wealth. Many invaluable seams of coal never could have been worked without the aid of such an instrument; and its long use throughout an extensive district, with the comparatively limited number of accidents, proves its claim to be considered, under ordinary circumstances, a safety-lamp. The principles of its construction appear to have been practically known to the witnesses, Clanny and Stevenson, previously to the period when Davy brought his powerful mind to bear upon the subject, and produced an instrument which will hand down his name to the latest ages. The attention of your Committee has been drawn by different witnesses to contingencies in mining, under which the lamp of Sir H. Davy ceases to afford adequate protection. Of the possible existence and nature of those contingencies, your Committee have ascertained that the inventor was well aware, and they regret that the cautions he gave to some of his immediate friends were not made more public. Accidents have occurred where his lamp was in general and careful use; no one survived to tell the tale how these occurrences took place; conjecture supplied the want of positive knowledge most unsatisfactorily; but incidents are recorded which prove what must follow unreasonable testing of the security of that lamp; and your Committee are constrained to believe, that ignorance and a false reliance upon its merits, in cases attended with unwarrantable risk, have led to disastrous consequences. The proofs collected in support of this opinion may be considered so many warnings to the miners of England. The prejudices which exist in many districts against the employment of the Davy lamp, are not occasioned by doubts of its protective character: the complaints made are of too little light, and the difficulty, in comparison with the use of the common candle, in bringing that light to bear with precision on the work, particularly in the thicker seams which are found in Warwickshire, Staffordshire, and other counties. Notwithstanding these prejudices, your Committee conceive that no employer of miners can be justified in allowing caprice, or inconvenience to certain individuals, to interfere with a due protection to the lives of his work-people. In some mines, now lighted by the ordinary means, the use of the lamp ought, in the judgment of your Committee, to be compelled by the owners. Many improvements, calculated to lessen the number of dangerous contingencies already alluded to, have been suggested; all these may be considered as extensions of the principle; such are the lamps produced by Messrs. Upton and Roberts, Mr. Newman, Mr. Martin, Mr. Douglas, Mr. Wood, and Mr. Dillon. The lamps of Dr. Clanny and Mr. Ayres are provided with additional mechanical contrivances intended to exclude danger, which might overcome the safety principle, and at once warn the miner of the insecurity of his situation, by the extinction of his light. All these are described in the evidence, except Mr. W. Martin's—a drawing which accompanies will serve that object; and Mr. Ayres's, which is a suspended extinguisher, descending on the flame immediately the gas inside the gauze is ignited: this lamp cannot be opened or interfered with without producing such extinction. Your Committee have not ascertained how far the extinction of the lighted wick would also be accompanied by the extinction of the burning gas surrounding it.

In the experiments made before your Committee at the London University, it may possibly be remarked, that the tests applied were not such, in nature or mode of application, as the known actual condition of the mines would point out as satisfactory. It must not be forgotten, that the object of those experiments was to ascertain which, of all the lamps produced, was, when exposed to the severest trial, best entitled to the name of "a safety-lamp." In these experiments, the explosion of the gases within the lamp was effected in every one, and similar explosions produced externally, save Messrs. Upton and Roberts's. Your Committee are therefore decidedly convinced, that its construction possesses paramount merit. Your Committee cannot admit that these experiments had any tendency to detract from the character of Sir H. Davy, or to disparage the fair value placed by himself upon his invention. The improvements are probably those which longer life and additional facts would have induced him to contemplate as desirable, and of which, had he not been the inventor, he might have become the patron. With the sole exception of unexpected destruction of the instrument, Messrs. Upton and Roberts's lamp appears to your Committee to provide against all, or nearly all, the contingencies attending the Davy lamp. Mr. Buddle states, that tin shields, and a partial concealment of the lamp under their dress, constitute the prudential precautions taken by the miners in dangerous situations, to prevent the flame passing the gauze when the lamp is agitated. The glass chamber does all this with greater certainty; its sudden fracture leaves the instrument a perfect lamp on Sir H. Davy's construction. The introduction of the glass is not new; the novelties are, the shape of the glass, the collar which regulates the admission of air or gas to the cotton-wick, and the double tissue of gauze beneath the wick, which prevents firing backward. If no practical objections are discovered, and your Committee do not contemplate any which may not be readily overcome, Messrs. Upton and Roberts's lamp will supply a grand desideratum, especially if extensive experience should prove that the lamp and area of the gauze may be so increased as to allow of more light with safety.

On the necessity of having correct maps and plans, your Committee have already reported. The long catalogue of casualties to which the miner is subject will be found detailed in the evidence. Mr. Roberts, one of the witnesses, produced to your Committee his safety-hood, to enable persons to enter drains, wells, and mines, charged with carbonic acid gas. Your Committee report with pleasure their opinion of its great value, and of the merit of the inventor. The advantages to be obtained by having the safety-hood always ready for use are by no means hypothetical; interesting proofs of what may be effected by its use have been received, and the practicability of saving life after explosions, when no hope remained, has been demonstrated.

On a review of their labours, your Committee cannot but feel apprehension that they have in great measure failed in devising adequate remedies for the painful calamities they have had to investigate; they entertain, notwithstanding, a sanguine expectation that the attention of the public will be availingly turned to this interesting subject. The aid they have received from many scientific and philanthropic characters in the course of this inquiry, and the disinterested zeal the parties have manifested, warrant these hopes. How far legislative enactments might come fairly in aid of the miner has had the serious consideration of your Committee; the great dissimilarity of the mineral stratifications of the kingdom, the constantly varying circumstances of particular mines, render it, in their opinion, impossible at present to lay down any precise directions, or to form any rules of universal application. Your Committee agree with many intelligent witnesses, that great benefit might be fairly and sanguinely anticipated from men of known ability being encouraged to visit the mines, whether in the character of distinguished chemists, mechanists, or philanthropists. Your Committee are assured that these visits would be received with pleasure by the mine-owners, and that every assistance in the way of experimenting would be promptly afforded. They retain a grateful recollection of the results which followed the visits of Sir H. Davy.

On considering what may be due to the comfort and welfare of a class of men who, at great personal risk, contribute largely to the necessities, luxuries, and wealth, of this great empire; the immense value of these mines to the community; the loss of life which has occurred, and the benefits which have already accrued from the labours and investigations of scientific characters; your Committee have been disposed maturely to weigh the suggestions which have been made to them upon the necessity of having this inquiry continued in the mining districts by competent individuals, acting under authority. They are not insensible to the advantages which might result from such a proceeding; but many serious objections having been stated to the proposition, your Committee conclude, under present circumstances, to abstain from giving an opinion upon the necessity or expediency of such a course. Your Committee are glad to find that increasing attention is paid to the moral culture and education of the mining population. From the establishment of associations similar to the Polytechnic School recently formed in Cornwall, as named by one or more witnesses, and the opportunity thus afforded of cultivating native talents, great advantages may be anticipated. Whilst your Committee have, in the case just alluded to, had pleasing proof of the solicitude with which the welfare and safety of the miners are consulted in many places, they cannot express the sense they entertain of the responsibility incurred by the owners of mines generally; in their hands are the lives of a vast number of their fellow-creatures, industriously contributing to their personal and our national aggrandisement. The dependence placed upon agents and managers is necessarily great, and doubtless, in many instances, from the characters of the individuals, justifiable. The number of subordinate overseers, under whatever name, ought never to be reduced on any pretence of economy; a vigilant oversight of these on the part of the owners, viewers, or managers, as well as a determination to employ none in responsible stations who have not recommended themselves by long experience, skill, sobriety, and habits of strict attention, may prevent many accidents. It is the bounden duty of these owners carefully and constantly to examine into the state of their mines; if this is not personally practicable, they ought to call for written daily reports from their subalterns, of every circumstance and event connected with the proper ventilation of the mine. There will, however, still remain to be exercised that quick perception of cause and effect, that accurate adaptation of means to the end, that nice observation of various natural phenomena connected with the state of the atmosphere at the surface and under ground, upon which, it is obvious, safety must ultimately depend. Every possible exertion should be made, every effort employed to bring the workmen acquainted with their individual responsibilities, and those theories and principles, both as regards the lamps and proper ventilation, upon the observance of which their personal existence and that of their comrades are at stake.

In conclusion, your Committee regret that the results of this inquiry have not enabled them to lay before the House any particular plan by which the accidents in question may be avoided with certainty, and in consequence no decisive recommendations are offered. They anticipate great advantages to the public and to humanity, from the circulation of the mass of valuable evidence they have collected. They feel assured that science will avail itself of the information, if not for the first time obtained, yet now prominently exhibited; and that the parties for whose more immediate advantage the British Parliament undertook the inquiry, will not hesitate to place a generous construction on the motives and intentions of the Legislature.

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MR. HERAPATH'S RAILWAY THEOREMS.

Sir,—I shall make no apology for presuming that Anti-Carper and the challenger of the Royal Society (Mr. Herapath) are one and the same. The profound reasoning which he has exhibited in his last article (No. 635), under the signature of Anti-Carper, betrays the writer as plainly as if he had given his name and place of residence.

Mr. Herapath begins by nibbling at the theorem $\sqrt{V^2 + 2gh)} \cdot \frac{15}{22}$; and to spare himself the mortification of applying his own infinite velocity theorem, $\frac{30}{1 - \frac{h}{22}}$, he supposes $V = o$, and calculates that when the ascent is 1 foot per mile, the velocities for 1, 4, 9, &c. miles will be 5·45, 10·9, 16·35. So that, says Mr. Herapath, "in a plane falling no more than one foot per mile, a velocity might ultimately be obtained of 100 or 1,000 miles per hour," &c. Mr. Herapath takes care, however, to say nothing about the distance the engines and train must travel *before* they gain such a velocity. It is true, if we can suppose that steam could be applied so as just to balance friction, and that without any stoppage, a distance of 33,620 miles of railway could be accomplished (*only* 8 or 9,000 miles more than the circumference of our globe), such a velocity would take place. The exact quantities of fuel and water necessary for such a journey being, of course, matters which Mr. Herapath would easily undertake to calculate. Mr. Herapath then goes on to state, "The theorem (he fancies that I am the inventor of the theorem—I wish I could say so) is unlimited as to load, and therefore it is immaterial whether the load *be a pound or 1,000 tons*, &c." I must tell Mr. Herapath, that although this reads very well, still, at the same time, it is arrant nonsense. I have supposed that the engine is capable of starting the load, and obtaining a velocity of 20 or 30 miles per hour on a horizontal plane, according to its powers: and if this can be done with a farthing rushlight, so much the better; it certainly would be a great saving, and worth, perhaps, Mr. Herapath's trying, delighting as he does in the marvellous. He next very gravely asks me, "Did I ever see a locomotive-engine, or converse with any one who had?" I answer, yes, both and often; but suppose I had not, would this make Mr. Herapath's *false theorems true?* In return, I must tell Mr. Herapath, that had he not asserted the contrary, I never would have supposed that he himself ever saw a locomotive-engine, or ever conversed with any one who knew any thing about the subject. Mr. H. proceeds in his usual profound way to conjure up the impossible equation $v = \sqrt{-h}.\ 5{\cdot}45$, and asks me how I am to manage it? His drift is here easily seen through; he knows right well that upon this part of the subject I have never yet said a single word, but it shall not escape me. He wishes to direct my attention from that part of my subject which I have not yet completed.

The next part of Mr. Herapath's article presents such a rich repast, that it must be given in his own words:—"Well, since this theorem will not answer up hill or down hill, let us try what it will do on a level. It is too bad if it will not help poor Iver M'Iver out here. In this case, when $h = o$ and $v = \frac{15}{22} V$, or the acquired velocity is $\frac{15}{22} V$, part of the starting velocity be what it may," &c. I am surprised that when Mr. H. made the above notable discovery, he did not adorn it with a dozen points of admiration. I can easily conceive that for once he may have reposed himself upon a bed of roses, falsely imagining that I might have made myself a bed of thorns. But mark how a "plain tale" from "*poor Iver M'Iver*" will put him down and decide the question for the future, whether it shall be *poor*

Iver M'Iver, or *poor John Herapath.* In this equation $v = \sqrt{V^2 + 2 g s \sin. i} = \sqrt{V^2 + 2 g h}$ (which, I again repeat, is none of mine), it is expressly mentioned by every writer on the subject that V, g, s, and h, are given in feet, and the velocity v is expressed in feet per second. Hence by changing the theorem $\sqrt{V^2 + 2 g h}$ into $\sqrt{V^2 + 2 g h} \cdot \frac{15}{22}$, it expresses the velocity in miles per hour; so that when V is expressed in miles per hour, we must reduce it to feet, for this plain reason, that we cannot add feet and miles together, before we first reduce them to the same denomination. But, Mr. Editor, it would be insulting you, as well as your many scientific readers, to add one word more upon this foolish blunder of Mr. Herapath's.

Mr. Herapath concludes his notable article by referring to his 9th Letter, vol. xxiii. p. 425, where we will see his reason for limiting the descending plane to 6 feet per mile, &c. This forms what I have called Mr. Herapath's patch-work; neither shall it escape when the proper time comes. I shall not for some time, at least, take any notice of what Mr. H. may state in answer to this. I shall proceed in the way I promised at the conclusion of my last article.

Yours, &c.
IVER M'IVER.

Dec. 16, 1835.

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THE WHALE-SHIPS BESET IN THE ICE.

Sir,—In the event of a vessel going to the Arctic regions, with a view of discovering and relieving the crews of whaling vessels supposed to be frozen in there, might not a balloon be advantageously employed to reconnoitre? The plan would be, for a line of sufficient length to be secured to the bottom of the car, by which the balloon might be hauled down when required. The apparatus for inflating it with pure hydrogen, need not be either intricate, bulky, or expensive, if made by an experienced person; and pure hydrogen being used, the quantity required would be much less, and consequently the balloon might be of proportionally smaller dimensions than if coal gas (carburetted hydrogen), were employed.

Whether the state of atmosphere in such high latitudes might be prohibitory, I do not know.

To many the proposition may appear chimerical, but not so to those who are acquainted with the fact of General Jourdan, owing his victory at Fleuris in 1794 to the reconnoitering and communicating by signals of the position of the enemy, made by a French engineer from a balloon at an elevation of about 400 yards.

I am, Sir,
Your most obedient servant,
W. VERE.

Dec. 2, 1835.

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ON THE USE OF ZINC GUTTERS, ETC., AS A PREVENTIVE AGAINST THE SPREAD OF FIRE.

Sir,—I read with much surprise, in page 224 of your last Number, the suggestion of "Henricus," to use *zinc* for gutters instead of *lead*, in consequence of the power attributed to the former metal of "*resisting the flames.*"

Your correspondent can have but a very superficial acquaintance with the properties of the metal he recommends, or he would hardly have ventured to put forth a statement so much opposed to facts, as that to which I have referred. In the very same Number that contains Henricus' suggestion (644), the melting points of the two metals are stated to be, lead 612°, and zinc 700°.

The melting point of lead according to Crichton, is 612° of Fahrenheit's scale; that of zinc, according to Sir Humphrey Davy, is 680°. At all events, the melting points of these two metals approximate so nearly, that for any protection afforded to the exposed parts of a building against fire, there would be no practical difference between them.

In fact, had the gutters of the Penitentiary at Millbank been lined with zinc instead of lead, previous to the late fire (as now recommended), they would have melted just as soon, and left the rafters exposed in the same way as the leaden ones did.

Zinc, doubtless, possesses many qualities which render its employment for particular purposes highly advantageous, but the power of "resisting flame" is certainly not among the number. So far as it is considered in reference to fire, zinc is a very objectionable metal, for it is not only fusible at a comparatively low temperature, but also actually combustible. This metal, therefore, should never be employed in the construction of chimney-pots, cowls, and such like; for in the event of the chimney becoming foul and the soot taking fire, away goes the chimney-pot, "down below," in the form of a highly dangerous shower of ignited metal.

In consequence of the great improvements recently introduced in the manufacture of zinc, it is at this time in very extensive use, and is, as I before stated, in many instances most advantageously employed; but it has qualities which, in some degree, limit its usefulness, and those persons who recommend its indiscriminate use, can only do so upon the "*nothing like leather*" principle.

A plumber in this city some time since erected some additional workshops, which he covered in entirely with thin sheet copper turned;* this is a light and durable material, and is exceedingly pleasant to work; it can be jointed by soldering, either with or without lapping. It will resist a very considerable degree of heat, and may be safely employed where a heavier covering would be inadmissible.

I remain, Sir,
Yours respectfully,
W. Baddeley.

London, Dec. 16, 1835.

SHIP-SINKING SYSTEM.

Sir,—My remarks exposing the misrepresentations of the writer of the article in your July Number, entitled "Ship-sinking System," have, it seems, called forth the energies of Mr. Ballingall, who, in the present Part (November), undertakes to "verify and prove to be fact what your correspondent (First of June), alleges," and to that end has published a correspondence between himself and the secretary to Lloyd's Register of British and Foreign Shipping, with his own not very courteous remarks by way of explanation.

Having read the correspondence with the best attention of which I am capable, all that I can make of it (of course leaving Mr. B.'s comments out of the question), is simply this:—Mr. Ballingall has devised some plan for constructing ships, which he thinks superior to that in common use. He is anxious to introduce it to the public notice, and, therefore, writes to the Secretary to ascertain the opinion of the Committee, and, if possible, to obtain their recommendation of it to the public. The Committee seem to think (and, in my opinion, justly), that it is not authorised to pledge itself to assign a class to a ship before she is built, and to satisfy Mr. Ballingall, refer him to the *principles* upon which ships are classed, viz. their intrinsic qualities, taking into account the materials made use of and the mode of construction. Whatever opinion I might have previously formed of the conduct of the Committee, the answer given in this case has proved to my satisfaction, at least, that IT *does not consist of men who are combining to prevent good and safe ships from being built.* This was at one period Mr. Ballingall's own opinion, as is evident from the prominent part he took in a meeting held at Leith on the 6th of March last, when he moved the following resolution:—

> "That this Meeting having fully considered the rules for classification adopted in June last by the Provisional Committee for the Regulation of Lloyd's Register of British and Foreign Shipping, is of opinion, that they have not been adopted on any theoretical or practical knowledge of the strength or durability of the different kinds of timber therein mentioned, but are founded on prejudice or on information obtained from interested parties, and are for the *benefit of the few, to the evident injury of those ship-owners and ship-builders of the United Kingdom who are at a great distance from the great importing mercantile cities and the timber counties of England*."

The burden of this resolution is, that the Committee will not sanction the use of (what is in its estimation) inferior material in ships claiming to be placed in the highest class.

After this resolution follow several others requiring such an alteration of the Rules of Lloyd's Register of British and Foreign Shipping as would admit foreign oak timbers to be used to a much greater extent, or, in other words, to *lower* the standard of quality. These were followed by one, *approving the mode of construction* recommended by the rules, coupled with a suggestion to increase or require a heavier scantling. The scantlings adopted are of the minimum size that can be admitted as sufficient for ships hereafter to be built, and do not prevent, but rather encourage the adoption of a heavier scantling, by requiring that the size shall be independent of *sap* or *wane*, or, in other words, that the timber shall be of such size as at least to allow its being squared to the dimensions given in the table of scantlings, and *then* be free from sap.

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* Supplied by Messrs. Warners, Jewin Crescent.

Amongst other things it was declared at this Meeting at Leith, that the limitation of the use of foreign oak was merely conceded to conciliate the " worthies " at Lloyd's, and not because of " any conviction of its inferiority to British oak."

I had intended to make some remarks upon the fallacy of the pretensions put forth by Mr. Ballingall in behalf of what he calls *his plan* of construction; but I forbear, not being disposed to enter into a controversy with a man whose statements and writings in different publications are at variance with fact.

Since this letter was commenced, I have seen Mr. Ballingall's last letter in the *Mechanics' Magazine*, and observe, that he now calls himself *a naval architect*, and yet is found advocating the use of materials for ship-building, which are practically admitted even by the " worthies " at Leith to be inferior to English oak, or they would not give the high price they do for ships built entirely of British oak.

I am yours, &c.
AN OLD CORRESPONDENT.

P.S.—It seems from Mr. Ballingall's postscript to his letter, that he imagines caulking the ceiling is a new invention. It has been in use for time out of mind, and is still practised in most vessels employed in the corn and flour trade.

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THE ALMANACS FOR 1836.

(Concluded from our last, p. 239.)

Partridge's " *Merlinus Liberatus*," for the " 148th year of our Deliverance by King William III. from Popery and Arbitrary Government," is so good in its astronomical department, as to make us doubt whether we were right in saying in our last, that Moore is " unrivalled among the popular Ephemerides." Partridge is only not so communicative on this head as Moore, but in all that he does say he is equally correct and clear. We wish he had extended to the mundane portions of his work a little of the same care which he has bestowed on the celestial. In some of his year lists he is sadly inaccurate. In the course of only one page (35), we have Francis II., of Austria, wearing a crown, who, nearly a twelvemonth ago, was gathered to his fathers; Lord Denman denuded of his peerage, and enacting Lord Chief Justice as plain *Sir Thomas;* Sir W. E. Taunton, who is in his grave, occupying a seat on the bench; and Lord Lyndhurst sitting in that chair in which he was long ago so worthily succeeded by Lord Abinger!

Cardanus Rider, whose correct and copious Fair Lists, and Farm and Garden Directions, have obtained for his work a wide circulation among professional fair-goers and amateur cultivators, shows in his Notes on Husbandry and Gardening, that he keeps a vigilant eye on the march of improvement in those departments to which his attention is particularly devoted. We quote, by way of sample, a notice of Sir Henry Stuart's successful method of transplanting full-grown trees, which, if we may judge from the small number of imitators he has had, is by no means so well known as it deserves to be.

> *December.*—" This is the best time for transplanting large trees on the curious and important plan recently introduced by Sir H. Stuart. Any tree, even from 25 to 36 feet high, may be transplanted in this way:—A hole is dug for its reception a year before its removal. The tree is then dug under, and the roots are, with the utmost care, separated from the earth until very nearly all have been loosened. A large engine is then carried to the tree; it is no more than a long pole on an axle and wheels. The pole is lashed upright to the tree; it is then pulled to a horizontal position over the axle, and of course the tree is dragged with it. A ball of earth is left close to the stem; the roots and the branches are tied up, and the tree is carried in a balanced position to its destination. The roots are then liberated; the tree is let down into the pit; and with the utmost caution and precision, the roots, tier by tier, are imbedded in the sand by experienced workmen, and so expeditiously are they incorporated with the soil, that there is no necessity for any artificial props to support the tree. The expense of this removal averages from 10*s*. to 13*s*."

The Englishman is, as it has always been since it was first started, extremely accurate and complete, and (typographically considered) surpassingly neat; but presents this year no striking novelty, unless, perhaps, we may except a column in the calendar pages, in which the more remarkable geographical discoveries are very distinctly, yet briefly, indicated.

The Mechanics' Almanac may be considered as altogether a new almanac, having not only superseded the *Tradesman's and Mechanics' Almanac* of past years, but being on a wholly different plan. The almanac which has given way to it was intended to please two classes, which, though certainly within the relations of affinity, are by no means one and the same, either as to talents, acquirements, views, or feelings; and the consequence was, that it pleased neither. A mechanic may be also a tradesman, but it is not every tradesman, nor, indeed, one tradesman in five, who is a mechanic; and hence it is by no means surprising, when we look at the two classes, in their respective aggregates, that we should find the one, which is all mechanical, by much the better informed and more intelligent of the two. The *work*-shop has been at all times a much better school of learning than the *show*-shop, whether wholesale or retail. No one who is conversant with the workshops of England can have failed to observe how much more readily any matter above ordinary comprehension is there understood, especially if it be of a scientific description, than in any miscellaneous assemblage of shop-keepers, chapmen, hawkers, pedlars, *et id genus omne*. Yet, strange to say, " the time has been, nor far removed from date," when it was thought necessary, by certain diffusers of knowledge (very ignorant, of course, of the real wants of those they pretended to instruct) to *write down* to the level of mechanics! Write down, forsooth! Write *up* would have suited far better the relative circumstances of the parties. The compilers of the *Mechanics'* Almanac have happily steered quite clear of this besetting sin of the popular instructors of the day. The mechanics of England are here addressed as *men*, to whom there is nothing either too high to understand, or too good to enjoy. Neither labour nor expense seems to have been spared to make *their* almanac (for of its cordial adoption as such we make no doubt) not only one of the best of the day, but of a description much superior to the generality of these publications. It would be impossible in ten times the space we can afford to do full justice to the multifarious contents of this annual—the unceasing variety and closely-condensed quantity of whose contents surpass any thing of the kind that has hitherto come under our notice. In addition to the astronomical, commercial, parliamentary, and miscellaneous information, usually to be found in the best publications of a similar kind—this contains very copious historical and biographical reminiscences of each month, devoted especially to such matters as have reference to the progress of discovery in the arts and sciences. As a specimen of this part of the work, we open it at random, and in *one* page find notices of M. Charles the aeronaut, Eli Witney the inventor of the cotton-gin, William Bowyer the eminent printer, Sir Richard Arkwright, Sir Isaac Newton, Bernouilli, Boerhaave, &c. Nor are *these mere notices*—things of names and dates *only, but highly interesting* and detailed *memorials.* The smallness of the type, and the great care that has been taken in condensation and selection, render this department truly a " *multum in parvo*" repository of facts. As specimens we quote the following:—

" *March* 3, 1733.—Birthday of Dr. Joseph Priestley, a divine, a metaphysician, a politician, and a philosopher; in each of which characters he displayed abilities of a most rare, and occasionally exalted description. He was the first discoverer of oxygen, and made a great many other valuable contributions to chemical science. ' He made more of his time,' says Professor Brande, ' than any person of whom I ever read or heard; and possessed the happy and rare talent of passing from study to amusement, and from amusement to study, without occasionally any retrograde movement in the train and connexion of his thoughts.' In his political opinions he was so much ahead of the times in which he lived, as to become unfortunately an object of popular fury. During the Birmingham Riots of 1791, his house was sacked by a ' Church and King ' mob, and the whole of his library, manuscripts, and philosophical apparatus, cast into the flames. He fled from the persecution to which he was exposed to America, and took up his residence in Pennsylvania, where he died on the 4th of February 1804.

" *August* 1, 1774 —Oxygen-gas first discovered by Dr. Priestley. Although no being can breathe without its presence, and no plant can live, it had never before been identified as a distinct and separate element of nature. It was called at first, in conformity with a theory which then existed, but has been long exploded, *dephlogisticated* air, and subsequently received its present name from Lavoisier. In the same year (1774), Scheele, the celebrated Swedish chemist, without being acquainted with what Dr. Priestley had done, also discovered oxygen-gas, and gave it the name of *empyreal* air.

" *April* 13, 1749.—Joseph Bramah born. Incapacitated, when about sixteen years of age, by an accidental lameness, from following the occupation of his father, which was that of farming, he became a carpenter and joiner, and ultimately an engineer, in which profession he attained to great and deserved eminence. He was, without exception, the most prolific inventor of his age; and, next to James Watt, the most useful. He took out patents for upwards of twenty inventions, and made the world a present of almost as many as he patented. Among the most valuable productions of his inventive mind was the combination-lock and hydraulic-press, with which his name has been long identified, and the beer-machine now in universal use. He published an original and valuable letter on the law of patents, addressed to Judge Eyre, in reference to a trial for infringing Mr. Watt's patent for improvements in the steam-engine. He died on the 9th of December, 1814.

" *Dec.* 25, 1758.—First predicted return of Halley's comet, observed by George Palitsch, of Prolitz, near Dresden; ' a peasant by station,' says Sir John Herschel, ' but an astronomer by nature.' He possessed an eight-feet telescope, with which he made the discovery, and the next day communicated the fact to Dr. Hoffman, who immediately went to his cottage and saw the comet on the evenings of the 27th and 28th of December.'

We have also a classified list of all the patents taken out during the present year, and the number of those granted in each year since 1675—an abstract of the New Patent Act—and a list of rewards granted by Government, from 1703 to 1835, for inventions, discoveries, and improvements. On civic affairs we have a great mass of authentic information connected with the companies, corporations, and guilds. Next follows information on the state of the working-classes generally, such as tables of wages, &c. the mere titles of which would require more than a page to specify.

NOTES AND NOTICES.

Railway Table-Cloth.—A splendid table-cloth, presenting a portion of the Manchester Railway, with carriages, &c. is now on the loom at Tonge, near Middleton. The drawing is almost as accurate as if pencilled, the colours are exceedingly brilliant and distinct, and the portion of the work already executed, presents a panoramic view of the scene. The jacquard with which it is being woven, the design and the workmanship, are all executed by Lancashire artisans.

New India-Rubber Fabric.—A discovery has been recently made by Mr. C. Goodyear, by which India-rubber, after having been dissolved, can be restored by a cheap process to its ancient whiteness, and the pure grain formed into a fabric to be used instead of cloth, leather, or parchment, and can be moulded into almost any form; and can also be combined in a variety of ways with cloth, cordage, or leather. Being first made white, it admits of every shade of colour, worked in, and as durable as the rubber itself. A variety of fine specimens are now being exhibited at the Mechanics' Institute at Castle Garden, which will give an idea of the general utility of the invention.—*New York Journal of Commerce.*

French Patents.—During the last quarter, 145 patents have been granted by the French government, principally for inventions relative to printing, to the manufactory of native sugar, and of stuffs by locomotive machinery; to machinery of several kinds; to dyeing, perfumery, clothing, the art of curing, and music; one in particular, to a musical instrument-maker at Lyons, for a three-keyed bugle.—*Paris Advertiser.*

M. Arago, perpetual secretary of the French Institute, has just been elected a foreign member of the Academy of Science at Gottingen.—*Paris Advertiser.*

On the late very recent appointment of Professor Airy, the salary was raised to 800*l* a-year; but viewing the long established character of the present holder for scientific acquirements, and the ability he displayed in the high situation he held at Cambridge, there is little danger of his appointment being considered as "a Parliamentary job," though presented by the Treasury to a Cambridge man. Lord Melbourne, indeed, to do him justice, has now given up the patronage, of which the Treasury has hitherto been particularly tenacious, to the Board of Admiralty, together with the whole control and responsibility of the Royal Observatory. To no department of the Government, we will venture to say, could this patronage, control, and responsibility, be more properly intrusted, the original design of the Royal Observatory being, as its founder, Charles II., expressed himself, "for the use of my seamen."—*Quarterly Review.*

Opening of the First German Railway.—Nuremburg, Dec. 7.—In the morning at nine o'clock the iron railroad was opened in the manner named in the programme. M. Binder, the chief burgomaster, opened the ceremony with an address, while the band of the Regiment of Landwehr played the national hymn. The monumental stone was uncovered, which has on one side the cipher of the King, with the inscription, "Germany's first iron railroad, with steam-power, 1835" ("Deutschlands erste eisen-bahn, mit dampfkraft, 1835"): on the other side are the united arms of the two towns with the inscription, "Nuremburg and Furth.' After a short pause, the steam-carriage, with nine carriages for passengers attached to it, all decorated with the national colours, set out for Furth, while countless multitudes of spectators were assembled along the road. The carriages traversed the road three times, and were always filled with passengers. —*German paper.*

LIST OF NEW PATENTS, GRANTED BETWEEN THE 24TH OF NOVEMBER, AND 24TH OF DECEMBER, 1835.

Charles Pearse Chapman, of Cornhill, zinc-manufacturer, for his improvements in printing silks, calicoes, and other fabrics. Nov. 24; six months to specify.

James Hellewell, of Springfield-lane, Salford, Lancaster, dyer, for an improved process or manufacture whereby the texture of cotton, and certain other fabrics and materials, may be rendered impervious to water. Nov. 28; six months.

Humphrey Jefferies, of Birmingham, goldsmith and jeweller, for certain improvements in buttons. Nov. 28; six months.

Thomas Robert Sewell, of Carrington, Nottingham, lace-manufacturer, for certain improvements in machinery for making lace, commonly called bobbin-net. Dec. 2; six months.

James Cropper, of Nottingham, lace-manufacturer, and Thomas Brown Milnes, of Lenton-works, Nottingham, bleacher, for certain improvements in machinery for manufacturing lace or net commonly called bobbin-net lace. December 3; six months.

William Wainwright Potts, of Burslem, Stafford, for an improved method or process of producing patterns in one or more colours to be transferred to earthenware, porcelain, china, glass, and other similar substances. December 3; six months.

Bennett Woodcroft, of Ardwick, Manchester, gentleman, for improvements in printing calicoes and other fabrics, whether manufactured of cotton, silk, wool, or linen, or of all, or any two or three, of those materials. December 3; six months.

Thomas Parkin, of Dudley, Worcester, gentleman, for certain improvements in sleepers or bearers applicable to railroads. December 3; six months.

Alexander Gordon, of Fludyer-street, Westminster, and James Deville, of the Strand, lamp-manufacturer, for certain improvements in the production, maintenance, direction, or distribution of lights, parts of which improvements are applicable to other purposes. December 3; six months.

Richard Witty, of Stoke-upon-Trent, Stafford, civil engineer, for an improved method or methods of arranging and combining certain materials used in constructing houses, bridges, and other buildings, whereby superior strength and durability will be obtained. December 3; six months.

James Radley, of Oldham, Lancaster, gentleman, for certain improvements in the construction of gauges for indicating or measuring the expansive pressure of steam, or other elastic vapours or gases used expansively as a medium of power. December 4; six months.

Miles Berry, of No. 66, Chancery-lane, for a certain improvement or certain improvements in power-looms for weaving; being a communication from a foreigner residing abroad. December 5; six months.

Nathaniel Partridge, of Elm Cottage, near Stroud, Gloucester, gentleman, for the application of a certain composition paste or materials as an anti attrition applicable to the bearings of wheels and machinery generally. December 7; six months.

Robert William Sievier, of Henrietta-street, Cavendish square, gentleman, for an improved waterproof cloth or fabric made either elastic or non-elastic, applicable to various useful purposes and for an improved manufacture of waterproof hats or caps. December 7; six months.

Nathaniel Partridge, of Elm Cottage, near Stroud, Gloucester, gentleman, for a certain improvement or certain improvements in mixing and preparing oil paints, whereby a saving of ingredients commonly used will be effected. December 8; six months.

John Samuel Dawes, of Birmingham, Warwick, iron-master, for improvements in the manufacture of iron by the application of certain known materials, and for improvements in preparing such materials, and for the recovery of certain products in the process of manufacturing iron. December 9; six months.

Jeremiah Horsfall, and James Kenyon, both of Addingham, York, cottin-spinners, for certain improvements in engines used for carding cotton, wool, and other fibrous substances. December 9; six months.

John Bertie, of Basford, Nottingham, lace-maker, for certain improvements in machinery for making bobbin-net lace, for the purpose of producing ornamented net or lace of various kinds, part of which improvements are in extension of certain improvements, for which Letters Patent were granted to him and one James Gibbons, bearing date the 5th June, 1834. December 9; six months.

John Houldsworth, of Glasgow, cotton-spinner, for certain improvements applicable to drawing and shibbing frames, used in the manufacture of cotton and other fibrous substances; being a communication from a foreigner residing abroad. December 9; six months.

Lightly Simpson, of Manchester, chemist, for an improvement in the preparation of certain colours to be used for printing cotton and other fabrics. December 10; six months.

Frederick Hempel, of Prainenburg, in the kingdom of Prussia, doctor of chemistry, now residing at Great Portland-street, for certain improvements in oxidizing or oxidinizing certain animal or vegetable substances, and for separating the several and different parts of such substances, and to render them, by means of different operations, not only separately, but also in combination with other materials capable of producing useful articles. December 15; six months.

Daniel Dewhurst, of Preston, Lancaster, flax-spinner, and Thomas Hope, Joseph Hope, and Isaac Hope, all of Manchester, Lancaster, mechanics, for certain new and improved machinery for spinning flax, hemp, cotton, silk, and other fibrous substances by power. December 16; two months.

William Carpmael, of Crawford-street, gentleman, for certain improvements in locomotive steam-carriages, part of which improvements are also applicable to steam-engines and boilers in general; being a communication from a foreigner residing abroad. December 16; six months.

Robert Griffiths, of Birmingham, Warwick, for improvements in machinery for making rivet, screw, blanks, and bolts December 16; six months.

William Coles, of Charing Cross, Esq., for certain improvements applicable to locomotive-carriages. December 16; six months.

John Osbaldeston, of Blackburn, Lancaster, weaver, for an improved method of making a metal heald or healds for the weaving of silk, woollen, worsted, cotton, or any other fibrous substance. *December 16; six months.*

Ovid Topham, of Whitecross street, engineer, for certain improvements in dressing, stearching, cleaning, and drying lace or net, known by the trade by the term of getting up lace or net. December 16; six months.

John Warwick, of No. 9, Three Kings-court, Lombard-street, merchant, for an improved lock and key; being a communication from a foreigner residing abroad. December 16; six months.

Henry Booth, of Liverpool, gentleman, for an improved method of attaching railway carriages together, for the purpose of obtaining steadiness and smoothness of motion. December 16; two months.

Pierre Erard, of Great Marlborough-street, for certain improvements on harps. December 18; six months.

John Baillie, of Great Suffolk-street Southwark, engineer, and John Paterson, of Mincing-lane, London, gentleman, for improvements in propelling of vessels and other floating bodies by means of steam or other power. December 21; six months.

Thomas Howell, of Clare-street, Bristol, for certain improvements in musical instruments. December 21; six months.

Nicholas Troughton, of Broad-street, London, merchant, for improvements in the process of obtaining copper from copper ores. December 21; six months.

John Thomas Betts, of Smithfield Bars, London, rectifier, for improvements in the process of preparing spirituous liquors in the making of brandy; being a communication from a foreigner residing abroad. December 22; six months.

John Heathcoat, of Tiverton, Devon, lace manufacturer, for a method or methods of weaving or manufacturing divers kinds of goods and wares, and for machines or machinery applicable thereto. December 24; six months.

☞ Patents taken out with economy and despatch; Specifications prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

Errata.—In the article on the "Culture of the Vine," p. 137 :—

1st col. line 27, *for* "branches" *read* "bunches."
2d col line 10, — "branches" —— "bunches."
———— 15, — "branch" —— "bunch."
———— 22, — "branch" —— "bunch."

Last Number, p. 234, col. 2, line 33, for "*questio vexatio*" read "*quæstio vexata.*"

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price *6d.* Also, the volume complete, in boards, price *9s. 6d.*

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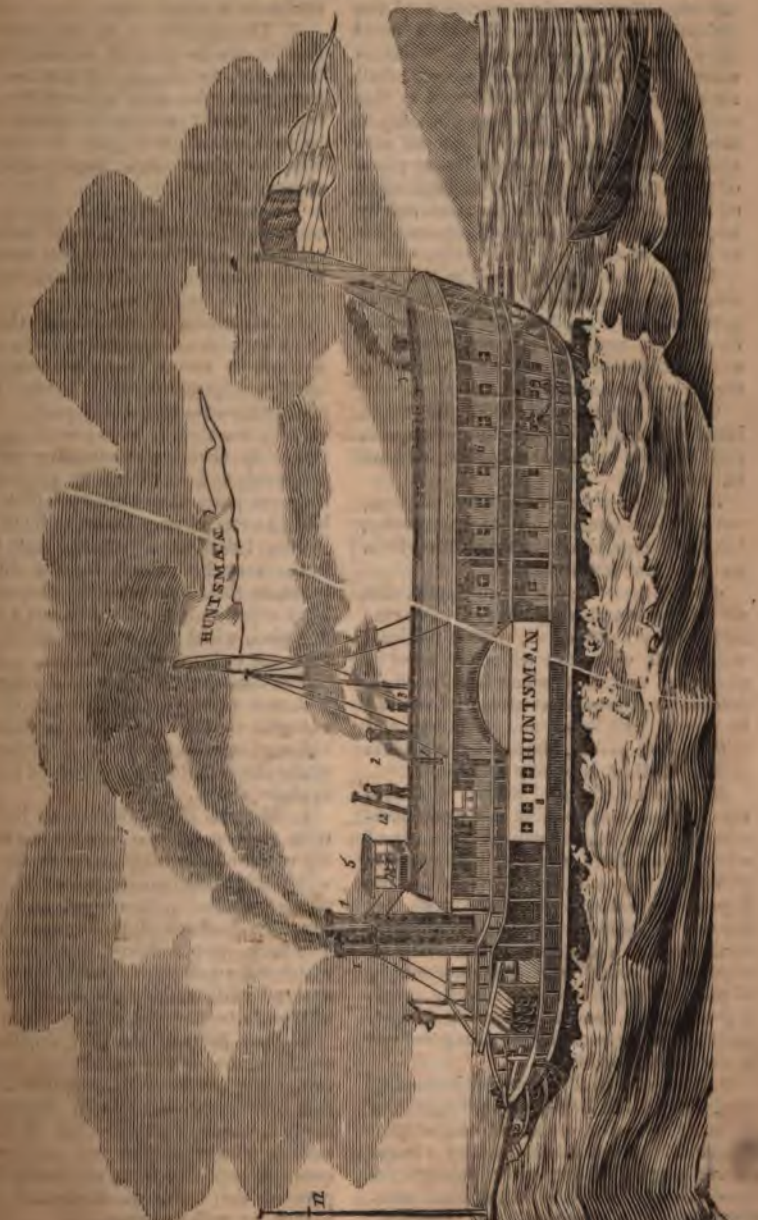

THE AMERICAN STEAMER, "HUNTSMAN."

stances, a safety-lamp. The principles of its construction appear to have been practically known to the witnesses, Clanny and Stevenson, previously to the period when Davy brought his powerful mind to bear upon the subject, and produced an instrument which will hand down his name to the latest ages. The attention of your Committee has been drawn by different witnesses to contingencies in mining, under which the lamp of Sir H. Davy ceases to afford adequate protection. Of the possible existence and nature of those contingencies, your Committee have ascertained that the inventor was well aware, and they regret that the cautions he gave to some of his immediate friends were not made more public. Accidents have occurred where his lamp was in general and careful use; no one survived to tell the tale how these occurrences took place; conjecture supplied the want of positive knowledge most unsatisfactorily; but incidents are recorded which prove what must follow unreasonable testing of the security of that lamp; and your Committee are constrained to believe, that ignorance and a false reliance upon its merits, in cases attended with unwarrantable risk, have led to disastrous consequences. The proofs collected in support of this opinion may be considered so many warnings to the miners of England. The prejudices which exist in many districts against the employment of the Davy lamp, are not occasioned by doubts of its protective character: the complaints made are of too little light, and the difficulty, in comparison with the use of the common candle, in bringing that light to bear with precision on the work, particularly in the thicker seams which are found in Warwickshire, Staffordshire, and other counties. Notwithstanding these prejudices, your Committee conceive that no employer of miners can be justified in allowing caprice, or inconvenience to certain individuals, to interfere with a due protection to the lives of his work-people. In some mines, now lighted by the ordinary means, the use of the lamp ought, in the judgment of your Committee, to be compelled by the owners. Many improvements, calculated to lessen the number of dangerous contingencies already alluded to, have been suggested; all these may be considered as extensions of the principle; such are the lamps produced by Messrs. Upton and Roberts, Mr. Newman, Mr. Martin, Mr. Douglas, Mr. Wood, and Mr. Dillon. The lamps of Dr. Clanny and Mr. Ayres are provided with additional mechanical contrivances intended to exclude danger, which might overcome the safety principle, and at once warn the miner of the insecurity of his situation, by the extinction of his light. All these are described in the *evidence, except Mr. W. Martin*'s—*a drawing which accompanies* will serve that object; and Mr. Ayres's, which is a suspended extinguisher, descending on the flame immediately the gas inside the gauze is ignited: this lamp cannot be opened or interfered with without producing such extinction. Your Committee have not ascertained how far the extinction of the lighted wick would also be accompanied by the extinction of the burning gas surrounding it.

In the experiments made before your Committee at the London University, it may possibly be remarked, that the tests applied were not such, in nature or mode of application, as the known actual condition of the mines would point out as satisfactory. It must not be forgotten, that the object of those experiments was to ascertain which, of all the lamps produced, was, when exposed to the severest trial, best entitled to the name of "a safety-lamp." In these experiments, the explosion of the gases within the lamp was effected in every one, and similar explosions produced externally, save Messrs. Upton and Roberts's. Your Committee are therefore decidedly convinced, that its construction possesses paramount merit. Your Committee cannot admit that these experiments had any tendency to detract from the character of Sir H. Davy, or to disparage the fair value placed by himself upon his invention. The improvements are probably those which longer life and additional facts would have induced him to contemplate as desirable, and of which, had he not been the inventor, he might have become the patron. With the sole exception of unexpected destruction of the instrument, Messrs. Upton and Roberts's lamp appears to your Committee to provide against all, or nearly all, the contingencies attending the Davy lamp. Mr. Buddle states, that tin shields, and a partial concealment of the lamp under their dress, constitute the prudential precautions taken by the miners in dangerous situations, to prevent the flame passing the gauze when the lamp is agitated. The glass chamber does all this with greater certainty; its sudden fracture leaves the instrument a perfect lamp on Sir H. Davy's construction. The introduction of the glass is not new; the novelties are, the shape of the glass, the collar which regulates the admission of air or gas to the cotton-wick, and the double tissue of gauze beneath the wick, which prevents firing backward. If no practical objections are discovered, and your Committee do not contemplate any which may not be readily overcome, Messrs. Upton and Roberts's lamp will supply a grand desideratum, especially if extensive experience should prove that the lamp and area of the gauze may be so increased as to allow of more light with safety.

On the necessity of having correct maps and plans, your Committee have already reported. The long catalogue of casualties to

the miner is subject will be found de-
in the evidence. Mr. Roberts, one of
itnesses, produced to your Committee
afety-hood, to enable persons to enter
s, wells, and mines, charged with car-
acid gas. Your Committee report with
are their opinion of its great value, and
merit of the inventor. The advantages
obtained by having the safety-hood
s ready for use are by no means hypo-
al; interesting proofs of what may be
ed by its use have been received, and the
icability of saving life after explosions,
no hope remained, has been demon-
d.

a review of their labours, your Com-
e cannot but feel apprehension that they
in great measure failed in devising ade-
remedies for the painful calamities they
had to investigate; they entertain, not-
tanding, a sanguine expectation that the
tion of the public will be availingly
d to this interesting subject. The aid
have received from many scientific and
nthropic characters in the course of this
ry, and the disinterested zeal the parties
manifested, warrant these hopes. How
gislative enactments might come fairly
l of the miner has had the serious con-
ation of your Committee; the great dis-
arity of the mineral stratifications of
ingdom, the constantly varying circum-
es of particular mines, render it, in their
on, impossible at present to lay down
recise directions, or to form any rules of
rsal application. Your Committee agree
many intelligent witnesses, that great
it might be fairly and sanguinely anti-
ed from men of known ability being en-
aged to visit the mines, whether in the
acter of distinguished chemists, mecha-
or philanthropists. Your Committee
ssured that these visits would be received
pleasure by the mine-owners, and that
assistance in the way of experimenting
l be promptly afforded. They retain a
ful recollection of the results which
ved the visits of Sir H. Davy.

considering what may be due to the
ort and welfare of a class of men who, at
personal risk, contribute largely to the
sities, luxuries, and wealth, of this great
re; the immense value of these mines to
ommunity; the loss of life which has
red, and the benefits which have already
ed from the labours and investigations
ientific characters; your Committee
been disposed maturely to weigh the
stions which have been made to them
the necessity of having this inquiry con-
d in the mining districts by competent
iduals, acting under authority. They
ot insensible to the advantages which
result from such a proceeding; but many serious objections having been stated to the proposition, your Committee conclude, under present circumstances, to abstain from giving an opinion upon the necessity or expediency of such a course. Your Committee are glad to find that increasing attention is paid to the moral culture and education of the mining population. From the establishment of associations similar to the Polytechnic School recently formed in Cornwall, as named by one or more witnesses, and the opportunity thus afforded of cultivating native talents, great advantages may be anticipated. Whilst your Committee have, in the case just alluded to, had pleasing proof of the solicitude with which the welfare and safety of the miners are consulted in many places, they cannot express the sense they entertain of the responsibility incurred by the owners of mines generally; in their hands are the lives of a vast number of their fellow-creatures, industriously contributing to their personal and our national aggrandisement. The dependence placed upon agents and managers is necessarily great, and doubtless, in many instances, from the characters of the individuals, justifiable. The number of subordinate overseers, under whatever name, ought never to be reduced on any pretence of economy; a vigilant oversight of these on the part of the owners, viewers, or managers, as well as a determination to employ none in responsible stations who have not recommended themselves by long experience, skill, sobriety, and habits of strict attention, may prevent many accidents. It is the bounden duty of these owners carefully and constantly to examine into the state of their mines; if this is not personally practicable, they ought to call for written daily reports from their subalterns, of every circumstance and event connected with the proper ventilation of the mine. There will, however, still remain to be exercised that quick perception of cause and effect, that accurate adaptation of means to the end, that nice observation of various natural phenomena connected with the state of the atmosphere at the surface and under ground, upon which, it is obvious, safety must ultimately depend. Every possible exertion should be made, every effort employed to bring the workmen acquainted with their individual responsibilities, and those theories and principles, both as regards the lamps and proper ventilation, upon the observance of which their personal existence and that of their comrades are at stake.

In conclusion, your Committee regret that the results of this inquiry have not enabled them to lay before the House any particular plan by which the accidents in question may be avoided with certainty, and in consequence no decisive recommendations are offered. They anticipate great advantages to the public and to humanity, from the circulation of the mass of valuable evidence they have collected. They feel assured that science will avail itself of the information, if not for the first time obtained, yet now prominently exhibited; and that the parties for whose more immediate advantage the British Parliament undertook the inquiry, will not hesitate to place a generous construction on the motives and intentions of the Legislature.

MR. HERAPATH'S RAILWAY THEOREMS.

Sir,—I shall make no apology for presuming that Anti-Carper and the challenger of the Royal Society (Mr. Herapath) are one and the same. The profound reasoning which he has exhibited in his last article (No. 635), under the signature of Anti-Carper, betrays the writer as plainly as if he had given his name and place of residence.

Mr. Herapath begins by nibbling at the theorem $\sqrt{V^2+2gh})\cdot\frac{15}{22}$; and to spare himself the mortification of applying his own infinite velocity theorem, $\frac{30}{1-\frac{h}{22}}$, he supposes $V=o$, and calculates that when the ascent is 1 foot per mile, the velocities for 1, 4, 9, &c. miles will be 5·45, 10·9, 16·35. So that, says Mr. Herapath, "in a plane falling no more than one foot per mile, a velocity might ultimately be obtained of 100 or 1,000 miles per hour," &c. Mr. Herapath takes care, however, to say nothing about the distance the engines and train must travel *before* they gain such a velocity. It is true, if we can suppose that steam could be applied so as just to balance friction, and that without any stoppage, a distance of 33,620 miles of railway could be accomplished (*only* 8 or 9,000 miles more than the circumference of our globe), such a velocity would take place. The exact quantities of fuel and water necessary for such a journey being, of course, matters which Mr. Herapath would easily undertake to calculate. Mr. Herapath then goes on to state, "The theorem (he fancies that I am the inventor of the theorem—I wish I could say so) is unlimited as to load, and therefore it is immaterial whether the load *be a pound or 1,000 tons*, &c." I must tell Mr. Herapath, that although this reads very well, still, at the same time, it is arrant nonsense. I have supposed that the engine is capable of starting the load, and obtaining a velocity of 20 or 30 miles per hour on a horizontal plane, according to its powers: and if this can be done with a farthing rushlight, so much the better; it certainly would be a great saving, and worth, perhaps, Mr. Herapath's trying, delighting as he does in the marvellous. He next very gravely asks me, "Did I ever see a locomotive-engine, or converse with any one who had?" I answer, yes, both and often; but suppose I had not, would this make Mr. Herapath's *false theorems true?* In return, I must tell Mr. Herapath, that had he not asserted the contrary, I never would have supposed that he himself ever saw a locomotive-engine, or ever conversed with any one who knew any thing about the subject. Mr. H. proceeds in his usual profound way to conjure up the impossible equation $v=\sqrt{-h}$. 5·45, and asks me how I am to manage it? His drift is here easily seen through; he knows right well that upon this part of the subject I have never yet said a single word, but it shall not escape me. He wishes to direct my attention from that part of my subject which I have not yet completed.

The next part of Mr. Herapath's article presents such a rich repast, that it must be given in his own words:—"Well, since this theorem will not answer up hill or down hill, let us try what it will do on a level. It is too bad if it will not help poor Iver M'Iver out here. In this case, when $h=o$ and $v=\frac{15}{22}V$, or the acquired velocity is $\frac{15}{22}V$, part of the starting velocity be what it may," &c. I am surprised that when Mr. H. made the above notable discovery, he did not adorn it with a dozen points of admiration. I can easily conceive that for once he may have reposed himself upon a bed of roses, falsely imagining that I might have made myself a bed of thorns. But mark how a "plain tale" from "*poor Iver M'Iver*" will put him down and decide the question for the future, whether it shall be *poor*

M'Iver, or *poor John Herapath.*

is equation $v = \sqrt{V^2 + 2 g s \sin. i}$ $\overline{V^2 + 2 g h}$ (which, I again repeat, ne of mine), it is expressly men- l by every writer on the subject that *s*, and *h*, are given in feet, and the ity *v* is expressed in feet per se- Hence by changing the theorem $\overline{+ 2 g h}$ into $\sqrt{V^2 + 2 g h} \cdot \frac{15}{22}$, it sses the velocity in miles per hour; it when V is expressed in miles per we must reduce it to feet, for this reason, that we cannot add feet and together, before we first reduce them e same denomination. But, Mr. r, it would be insulting you, as is your many scientific readers, to one word more upon this foolish ler of Mr. Herapath's.

. Herapath concludes his notable by referring to his 9th Letter, vol. p. 425, where we will see his reason miting the descending plane to 6 per mile, &c. This forms what I called Mr. Herapath's patch-work; r shall it escape when the proper comes. I shall not for some time, st, take any notice of what Mr. H. state in answer to this. I shall ed in the way I promised at the sion of my last article.

Yours, &c.
IVER M'IVER.

16, 1835.

◆

WHALE-SHIPS BESET IN THE ICE.

,—In the event of a vessel going to rctic regions, with a view of dis- ng and relieving the crews of whal- ssels supposed to be frozen in there, not a balloon be advantageously yed to reconnoitre? The plan be, for a line of sufficient length secured to the bottom of the car, hich the balloon might be hauled when required. The apparatus for ng it with pure hydrogen, need not her intricate, bulky, or expensive, le by an experienced person; and hydrogen being used, the quantity ed would be much less, and conse- y the balloon might be of propor- y smaller dimensions than if coal arburetted hydrogen), were em- L

Whether the state of atmosphere in such high latitudes might be prohibitory, I do not know.

To many the proposition may appear chimerical, but not so to those who are acquainted with the fact of General Jourdan, owing his victory at Fleuris in 1794 to the reconnoitering and communicating by signals of the position of the enemy, made by a French engineer from a balloon at an elevation of about 400 yards.

I am, Sir,
Your most obedient servant,
W. VERE.

Dec. 2, 1835.

◆

ON THE USE OF ZINC GUTTERS, ETC., AS A PREVENTIVE AGAINST THE SPREAD OF FIRE.

Sir,—I read with much surprise, in page 224 of your last Number, the suggestion of "Henricus," to use *zinc* for gutters instead of *lead*, in consequence of the power attributed to the former metal of "*resisting the flames.*"

Your correspondent can have but a very superficial acquaintance with the properties of the metal he recommends, or he would hardly have ventured to put forth a statement so much opposed to facts, as that to which I have referred. In the very same Number that contains Henricus' suggestion (644), the melting points of the two metals are stated to be, lead 612°, and zinc 700°.

The melting point of lead according to Crichton, is 612° of Fahrenheit's scale; that of zinc, according to Sir Humphrey Davy, is 680°. At all events, the melting points of these two metals approximate so nearly, that for any protection afforded to the exposed parts of a building against fire, there would be no practical difference between them.

In fact, had the gutters of the Penitentiary at Millbank been lined with zinc instead of lead, previous to the late fire (as now recommended), they would have melted just as soon, and left the rafters exposed in the same way as the leaden ones did.

Zinc, doubtless, possesses many qualities which render its employment for particular purposes highly advantageous, but the power of "resisting flame" is certainly not among the number. So far as it is considered in reference to fire, zinc is a very objectionable metal, for it is not only fusible at a comparatively low temperature, but also actually combustible. This metal, therefore, should never be employed in the construction of chimney-pots, cowls, and such like; for in the event of the chimney becoming foul and the soot taking fire, away goes the chimney-pot, "down below," in the form of a highly dangerous shower of ignited metal.

In consequence of the great improvements recently introduced in the manufacture of zinc, it is at this time in very extensive use, and is, as I before stated, in many instances most advantageously employed; but it has qualities which, in some degree, limit its usefulness, and those persons who recommend its indiscriminate use, can only do so upon the "*nothing like leather*" principle.

A plumber in this city some time since erected some additional workshops, which he covered in entirely with thin sheet copper turned;* this is a light and durable material, and is exceedingly pleasant to work; it can be jointed by soldering, either with or without lapping. It will resist a very considerable degree of heat, and may be safely employed where a heavier covering would be inadmissible.

I remain, Sir,
Yours respectfully,
W. BADDELEY.

London, Dec. 16, 1835.

SHIP-SINKING SYSTEM.

Sir,—My remarks exposing the misrepresentations of the writer of the article in your July Number, entitled "Ship-sinking System," have, it seems, called forth the energies of Mr. Ballingall, who, in the present Part (November), undertakes to "verify and prove to be fact what your correspondent (First of June), alleges," and to that end has published a correspondence between himself and the secretary to Lloyd's Register of British and Foreign Shipping, with his own not very courteous remarks by way of explanation.

Having read the correspondence with the best attention of which I am capable, all that I can make of it (of course leaving Mr. B.'s comments out of the question), is simply this:—Mr. Ballingall has devised some plan for constructing ships, which he thinks superior to that in common use. He is anxious to introduce it to the public notice, and, therefore, writes to the Secretary to ascertain the opinion of the Committee, and, if possible, to obtain their recommendation of it to the public. The Committee seem to think (and, in my opinion, justly), that it is not authorised to pledge itself to assign a class to a ship before she is built, and to satisfy Mr. Ballingall, refer him to the *principles* upon which ships are classed, viz. their intrinsic qualities, taking into account the materials made use of and the mode of construction. Whatever opinion I might have previously formed of the conduct of the Committee, the answer given in this case has proved to my satisfaction, at least, that IT *does not consist of men who are combining to prevent good and safe ships from being built.* This was at one period Mr. Ballingall's own opinion, as is evident from the prominent part he took in a meeting held at Leith on the 6th of March last, when he moved the following resolution:—

> "That this Meeting having fully considered the rules for classification adopted in June last by the Provisional Committee for the Regulation of Lloyd's Register of British and Foreign Shipping, is of opinion, that they have not been adopted on any theoretical or practical knowledge of the strength or durability of the different kinds of timber therein mentioned, but are founded on prejudice or on information obtained from interested parties, and are for the *benefit of the few, to the evident injury of those ship-owners and ship-builders of the United Kingdom who are at a great distance from the great importing mercantile cities and the timber counties of England.*"

The burden of this resolution is, that the Committee will not sanction the use of (what is in its estimation) inferior material in ships claiming to be placed in the highest class.

After this resolution follow several others requiring such an alteration of the Rules of Lloyd's Register of British and Foreign Shipping as would admit foreign oak timbers to be used to a much greater extent, or, in other words, to *lower* the standard of quality. These were followed by one, *approving the mode of construction* recommended by the rules, coupled with a suggestion to increase or require a heavier scantling. The scantlings adopted are of the minimum size that

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**Supplied by Messrs. Warners, Jewin Crescent.*

be admitted as sufficient for ships fter to be built, and do not prevent, ather encourage the adoption of a er scantling, by requiring that the hall be independent of *sap* or *wane*, other words, that the timber shall such size as at least to allow its squared to the dimensions given in ble of scantlings, and *then* be free sap.

ongst other things it was declared s Meeting at Leith, that the limita- f the use of foreign oak was merely ded to conciliate the "worthies" at l's, and not because of "any con- n of its inferiority to British oak."

ad intended to make some remarks the fallacy of the pretensions put by Mr. Ballingall in behalf of what lls *his plan* of construction; but I ar, not being disposed to enter into troversy with a man whose state- s and writings in different publica- are at variance with fact.

ce this letter was commenced, I seen Mr. Ballingall's last letter in *Mechanics' Magazine*, and observe, he now calls himself *a naval archi-* and yet is found advocating the use terials for ship-building, which are ically admitted even by the "wor- " at Leith to be inferior to English or they would not give the high they do for ships built entirely of h oak.

I am yours, &c.
AN OLD CORRESPONDENT.

S.—It seems from Mr. Ballingall's ript to his letter, that he imagines ing the ceiling is a new invention. been in use for time out of mind, s still practised in most vessels em- d in the corn and flour trade.

THE ALMANACS FOR 1836.

(Concluded from our last, p. 239.)

tridge's "*Merlinus Liberatus*," for the th year of our Deliverance by King m III. from Popery and Arbitrary Go- ent," is so good in its astronomical ment, as to make us doubt whether we ight in saying in our last, that Moore rivalled among the popular Epheme- Partridge is only not so communi- on this head as Moore, but in all that s say he is equally correct and clear. ish he had extended to the mundane s *of his work a little of* the same care which he has bestowed on the celestial. In some of his year lists he is sadly inaccurate. In the course of only one page (35), we have Francis II., of Austria, wearing a crown, who, nearly a twelvemonth ago, was gathered to his fathers; Lord Denman denuded of his peerage, and enacting Lord Chief Justice as plain *Sir Thomas;* Sir W. E. Taunton, who is in his grave, occupying a seat on the bench; and Lord Lyndhurst sitting in that chair in which he was long ago so worthily succeeded by Lord Abinger!

Cardanus Rider, whose correct and copious Fair Lists, and Farm and Garden Directions, have obtained for his work a wide circulation among professional fair-goers and amateur cultivators, shows in his Notes on Husbandry and Gardening, that he keeps a vigilant eye on the march of improvement in those departments to which his attention is particularly devoted. We quote, by way of sample, a notice of Sir Henry Stuart's successful method of transplanting full-grown trees, which, if we may judge from the small number of imitators he has had, is by no means so well known as it deserves to be.

December.—"This is the best time for transplanting large trees on the curious and important plan recently introduced by Sir H. Stuart. Any tree, even from 25 to 36 feet high, may be transplanted in this way:—A hole is dug for its reception a year before its removal. The tree is then dug under, and the roots are, with the utmost care, separated from the earth until very nearly all have been loosened. A large engine is then carried to the tree; it is no more than a long pole on an axle and wheels. The pole is lashed upright to the tree; it is then pulled to a horizontal position over the axle, and of course the tree is dragged with it. A ball of earth is left close to the stem; the roots and the branches are tied up, and the tree is carried in a balanced position to its destination. The roots are then liberated; the tree is let down into the pit; and with the utmost caution and precision, the roots, tier by tier, are imbedded in the sand by experienced workmen, and so expeditiously are they incorporated with the soil, that there is no necessity for any artificial props to support the tree. The expense of this removal averages from 10*s*. to 13*s*."

The Englishman is, as it has always been since it was first started, extremely accurate and complete, and (typographically considered) surpassingly neat; but presents this year no striking novelty, unless, perhaps, we may except a column in the calendar pages, in which the more remarkable geographical discoveries are very distinctly, yet briefly, indicated.

The Mechanics' Almanac may be considered as altogether a new almanac, having not only superseded the *Tradesman's and Mechanics' Almanac* of past years, but being on a wholly different plan. The almanac which has given way to it was intended to please two classes, which, though certainly within the relations of affinity, are by no means one and the same, either as to talents, acquirements, views, or feelings; and the consequence was, that it pleased neither. A mechanic may be also a tradesman, but it is not every tradesman, nor, indeed, one tradesman in five, who is a mechanic; and hence it is by no means surprising, when we look at the two classes, in their respective aggregates, that we should find the one, which is all mechanical, by much the better informed and more intelligent of the two. The *work*-shop has been at all times a much better school of learning than the *show*-shop, whether wholesale or retail. No one who is conversant with the workshops of England can have failed to observe how much more readily any matter above ordinary comprehension is there understood, especially if it be of a scientific description, than in any miscellaneous assemblage of shop-keepers, chapmen, hawkers, pedlars, *et id genus omne*. Yet, strange to say, "the time has been, nor far removed from date," when it was thought necessary, by certain diffusers of knowledge (very ignorant, of course, of the real wants of those they pretended to instruct) to *write down* to the level of mechanics! Write down, forsooth! Write *up* would have suited far better the relative circumstances of the parties. The compilers of the *Mechanics'* Almanac have happily steered quite clear of this besetting sin of the popular instructors of the day. The mechanics of England are here addressed as *men*, to whom there is nothing either too high to understand, or too good to enjoy. Neither labour nor expense seems to have been spared to make *their* almanac (for of its cordial adoption as such we make no doubt) not only one of the best of the day, but of a description much superior to the generality of these publications. It would be impossible in ten times the space we can afford to do full justice to the multifarious contents of this annual—the unceasing variety and closely-condensed quantity of whose contents surpass any thing of the kind that has hitherto come under our notice. In addition to the astronomical, commercial, parliamentary, and miscellaneous information, usually to be found in the best publications of a similar kind—this contains very copious historical and biographical reminiscences of each month, devoted especially to such matters as have reference to the progress of discovery in the arts and sciences. As a specimen of this part of the work, we open it at random, and in *one* page find notices of M. Charles the aeronaut, Eli Witney the inventor of the cotton-gin, William Bowyer the eminent printer, Sir Richard Arkwright, Sir Isaac Newton, Bernouilli, Boerhaave, &c. Nor are *these mere* notices—things of names and dates *only, but highly interesting* and detailed *memorials*. The smallness of the type, and the great care that has been taken in condensation and selection, render this department truly a "*multum in parvo*" repository of facts. As specimens we quote the following:—

"*March* 3, 1733.—Birthday of Dr. Joseph Priestley, a divine, a metaphysician, a politician, and a philosopher; in each of which characters he displayed abilities of a most rare, and occasionally exalted description. He was the first discoverer of oxygen, and made a great many other valuable contributions to chemical science. 'He made more of his time,' says Professor Brande, 'than any person of whom I ever read or heard; and possessed the happy and rare talent of passing from study to amusement, and from amusement to study, without occasionally any retrograde movement in the train and connexion of his thoughts.' In his political opinions he was so much ahead of the times in which he lived, as to become unfortunately an object of popular fury. During the Birmingham Riots of 1791, his house was sacked by a 'Church and King' mob, and the whole of his library, manuscripts, and philosophical apparatus, cast into the flames. He fled from the persecution to which he was exposed to America, and took up his residence in Pennsylvania, where he died on the 4th of February 1804.

"*August* 1, 1774.—Oxygen-gas first discovered by Dr. Priestley. Although no being can breathe without its presence, and no plant can live, it had never before been identified as a distinct and separate element of nature. It was called at first, in conformity with a theory which then existed, but has been long exploded, *dephlogisticated* air, and subsequently received its present name from Lavoisier. In the same year (1774), Scheele, the celebrated Swedish chemist, without being acquainted with what Dr. Priestley had done, also discovered oxygen-gas, and gave it the name of *empyreal* air.

"*April* 13, 1749.—Joseph Bramah born. Incapacitated, when about sixteen years of age, by an accidental lameness, from following the occupation of his father, which was that of farming, he became a carpenter and joiner, and ultimately an engineer, in which profession he attained to great and deserved eminence. He was, without exception, the most prolific inventor of his age; and next to James Watt, the most useful. He took out patents for upwards of twenty inventions, and made the world a present of almost as many as he patented. Among the most valuable productions of his inventive mind was the combination-lock and hydraulic-press, with which his name has been long identified, and the beer-machine now in universal use. He published an original and valuable letter on the law of patents, addressed to Judge Eyre, in reference to a trial for infringing Mr. Watt's patent for improvements in the steam-engine. He died on the 9th of December, 1814.

"*Dec.* 25, 1758.—First predicted return of Halley's comet, observed by George Palitsch, of Prohlitz, near Dresden; 'a peasant by station,' says Sir John Herschel, 'but an astronomer by nature.' He possessed an eight-feet telescope, with which he made the discovery, and the next day communicated the fact to Dr. Hoffman, who immediately went to his cottage and saw the comet on the evenings of the 27th and 28th of December.'

We have also a classified list of all the patents taken out during the present year, and the number of those granted in each year since 1675—an abstract of the New Patent Act—and a list of rewards granted by Government, from 1703 to 1835, for inventions, discoveries, and improvements. On civic affairs we have a great mass of authen-

mation connected with the com-
corporations, and guilds. Next fol-
rmation on the state of the working-
enerally, such as tables of wages, &c.
titles of which would require more
age to specify.

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NOTES AND NOTICES.

y Table-Cloth.—A splendid table-cloth,
a portion of the Manchester Railway,
iages, &c. is now on the loom at Tonge,
ileton. The drawing is almost as accurate
illed, the colours are exceedingly bril-
l distinct. and the portion of the work
xecuted, presents a panoramic view of the
he jacquard with which it is being woven,
and the workmanship, are all executed
shire arti-ans.

ndia-Rubber Fabric.—A discovery has
ntly made by Mr. C. Goodyear, by which
ber, after having been dissolved, can be
y a cheap process to its ancient whiteness,
ire grain formed into a fabric to be used in-
loth, leather, or parchment, and can be
into almost any form; and can also be
in a variety of ways with cloth, cordage,
r. Being first made white, it admits of
de of colour, worked in, and as durable as
r itself. A variety of fine specimens are
g exhibited at the Mechanics' Institute at
arden, which will give an idea of the
tility of the invention.—*New York Jour-
mmerce.*

Patents.—During the last quarter, 145
have been granted by the French govern-
ncipally for inventions relative to printing,
anufactory of native sugar, and of stuffs
otive machinery; to machinery of several
o dyeing, perfumery, clothing, the art of
nd music; one in particular, to a musical
nt-maker at Lyons, for a three-keyed
Paris Advertiser.

ago, perpetual secretary of the French
has just been elected a foreign member
cademy of Science at Gottingen.—*Paris
er.*

late very recent appointment of Professor
e salary was raised to 800*l* a-year; but
the long established character of the pre-
der for scientific acquirements, and the
e displayed in the high situation he held at
ge, there is little danger of his appoint-
ng considered as "a Parliamentary job,"
resented by the Treasury to a Cambridge
ord Melbourne, indeed, to do him justice,
given up the patronage, of which the
has hitherto been particularly tenacious,
oard of Admiralty, together with the whole
and responsibility of the Royal Observa-
o no department of the Government, we
ure to say, could this patronage, control,
onsibility, be more properly intrusted, the
design of the Royal Observatory being, as
der, Charles II., expressed himself, "for
f my seamen."—*Quarterly Review.*

*g of the First German Railway.—Nu-
Dec. 7.*—In the morning at nine o'clock
railroad was opened in the manner named
rogramme. M. Binder. the chief burgo-
pened the ceremony with an address, while
of the Regiment of Landwehr played the
hymn. The monumental stone was un-
which has on one side the cipher of the
ith the inscription, "Germany's first iron
with steam-power, 1835" ("Deutschlands
en-bahn, mit dampfkraft, 1835"): on the
e are the united *arms of the two towns*
e *inscription*, "*Nuremburg* and Furth."
After a short pause, the steam-carriage, with nine carriages for passengers attached to it, all decorated with the national colours, set out for Furth, while countless multitudes of spectators were assembled along the road. The carriages traversed the road three times, and were always filled with passengers. —*German paper*.

◆

LIST OF NEW PATENTS, GRANTED BETWEEN THE 24TH OF NOVEMBER, AND 24TH OF DECEMBER, 1835.

Charles Pearse Chapman, of Cornhill, zinc-manufacturer, for his improvements in printing silks, calicoes, and other fabrics. Nov. 24; six months to specify.

James Hellewell, of Springfield-lane, Salford, Lancaster, dyer, for an improved process of manufacture whereby the texture of cotton, and certain other fabrics and materials, may be rendered impervious to water. Nov. 28; six months.

Humphrey Jefferies, of Birmingham, goldsmith and jeweller, for certain improvements in buttons. Nov. 28; six months.

Thomas Robert Sewell, of Carrington, Nottingham, lace-manufacturer, for certain improvements in machinery for making lace, commonly called bobbin-net. Dec. 2; six months.

James Cropper, of Nottingham, lace-manufacturer, and Thomas Brown Mines, of Lenton-works, Nottingham, bleacher, for certain improvements in machinery for manufacturing lace or net commonly called bobbin-net lace. December 3; six months.

William Wainwright Potts, of Burslem, Stafford, for an improved method or process of producing patterns in one or more colours to be transferred to earthenware, porcelain, china, glass, and other similar substances. December 3; six months.

Bennett Woodcroft, of Ardwick, Manchester, gentleman, for improvements in printing calicoes and other fabrics, whether manufactured of cotton, silk, wool, or linen, or of all, or any two or three, of those materials. December 3; six months.

Thomas Parkin, of Dudley, Worcester, gentleman, for certain improvements in sleepers or bearers applicable to railroads. December 3; six months.

Alexander Gordon, of Fludyer-street, Westminster, and James Deville, of the Strand, lamp-manufacturer, for certain improvements in the production, maintenance, direction, or distribution of lights, parts of which improvements are applicable to other purposes. December 3; six months.

Richard Witty, of Stoke-upon-Trent, Stafford, civil engineer, for an improved method or methods of arranging and combining certain materials used in constructing houses, bridges, and other buildings, whereby superior strength and durability will be obtained. December 3; six months.

James Radley, of Oldham, Lancaster, gentleman, for certain improvements in the construction of gauges for indicating or measuring the expansive pressure of steam, or other elastic vapours or gases used expansively as a medium of power. December 4; six months.

Miles Berry, of No. 66, Chancery-lane, for a certain improvement or certain improvements in power-looms for weaving; being a communication from a foreigner residing abroad. December 5; six months.

Nathaniel Partridge, of Elm Cottage, near Stroud, Gloucester, gentleman, for the application of a certain composition paste or materials as an anti attrition applicable to the bearings of wheels and machinery generally. December 7; six months.

Robert William Sievier, of Henrietta-street, Cavendish square, gentleman, for an improved waterproof cloth or fabric made either elastic or non-elastic, applicable to various useful purposes and for an improved manufacture of waterproof hats or caps. December 7; six months.

Nathaniel Partridge, of Elm Cottage, near Stroud, Gloucester, gentleman, for a certain improvement or certain improvements in mixing and preparing oil paints, whereby a saving of ingredients commonly used will be effected. December 8; six months.

John Samuel Dawes, of Birmingham, Warwick, iron-master, for improvements in the manufacture of iron by the application of certain known materials, and for improvements in preparing such materials, and for the recovery of certain products in the process of manufacturing iron. December 9; six months.

Jeremiah Horsfall, and James Kenyon, both of Addingham, York, cottin-spinners, for certain improvements in engines used for carding cotton, wool, and other fibrous substances. December 9; six months.

John Bertie, of Basford, Nottingham, lace-maker, for certain improvements in machinery for making bobbin-net lace, for the purpose of producing ornamented net or lace of various kinds, part of which improvements are in extension of certain improvements, for which Letters Patent were granted to him and one James Gibbons, bearing date the 5th June, 1834. December 9; six months.

John Houldsworth, of Glasgow, cotton-spinner, for certain improvements applicable to drawing and shibbing frames, used in the manufacture of cotton and other fibrous substances; being a communication from a foreigner residing abroad. December 9; six months.

Lightly Simpson, of Manchester, chemist, for an improvement in the preparation of certain colours to be used for printing cotton and other fabrics. December 10; six months.

Frederick Hempel, of Prainenburg, in the kingdom of Prussia, doctor of chemistry, now residing at Great Portland-street, for certain improvements in oxidizing or oxidinizing certain animal or vegetable substances, and for separating the several and different parts of such substances, and to render them, by means of different operations, not only separately, but also in combination with other materials capable of producing useful articles. December 15; six months.

Daniel Dewhurst, of Preston, Lancaster, flax-spinner, and Thomas Hope, Joseph Hope, and Isaac Hope, all of Manchester, Lancaster, mechanics, for certain new and improved machinery for spinning flax, hemp, cotton, silk, and other fibrous substances by power. December 16; two months.

William Carpmael, of Crawford-street, gentleman, for certain improvements in locomotive steam-carriages, part of which improvements are also applicable to steam-engines and boilers in general; being a communication from a foreigner residing abroad. December 16; six months.

Robert Griffiths, of Birmingham, Warwick, for improvements in machinery for making rivet, screw, blanks, and bolts December 16; six months.

William Coles, of Charing Cross, Esq., for certain improvements applicable to locomotive-carriages. December 16; six months.

John Osbaldeston, of Blackburn, Lancaster, weaver, for an improved method of making a metal heald or healds for the weaving of silk, woollen, worsted, cotton, or any other fibrous substance. *December 16; six months.*

Ovid Topham, of Whitecross street, engine
certain improvements in dressing, stearching,
ing, and drying lace or net, known by the tr
the term of getting up lace or net. Decemb
six months.

John Warwick, of No. 9, Three Kings-
Lombard-street, merchant, for an improve
and key; being a communication from a for
residing abroad. December 16; six months.

Henry Booth, of Liverpool, gentleman,
improved method of attaching railway ca
together, for the purpose of obtaining ste
and smoothness of motion. December 1
months.

Pierre Erard, of Great Marlborough-stre
certain improvements on harps. December
months.

John Baillie, of Great Suffolk-street South
engineer, and John Paterson, of Mincin
London, gentleman, for improvements in pro
of vessels and other floating bodies by me
steam or other power. December 21; six m

Thomas Howell, of Clare-street, Brist
certain improvements in musical instruments.
cember 21; six months.

Nicholas Troughton, of Broad-street, Lo
merchant, for improvements in the process
taining copper from copper ores. Decembe
six months.

John Thomas Betts, of Smithfield Bars, Lo
rectifier, for improvements in the process o
paring spirituous liquors in the making of br
being a communication from a foreigner re
abroad. December 22; six months.

John Heathcoat, of Tiverton, Devon, lac
nufacturer, for a method or methods of weav
manufacturing divers kinds of goods and
and for machines or machinery applicable th
December 24; six months.

☞ Patents taken out with economy a
spatch; Specifications prepared or revised
veats entered; and generally every Bran
Patent Business promptly transacted. Dr
of Machinery also executed by skilful assi
on the shortest notice.

Errata.—In the article on the "Culture
Vine," p. 137 :—

1st col. line 27, *for* "branches" *read* "bun
2d col line 10, — "branches" —— "bun
———— 15, — "branch" —— "bun
———— 22, — "branch" —— "bun

Last Number, p. 234, col. 2, line 33, for "
tio veratio" read "*quæstio vexata.*"

The Supplement to the last volume, cont
title, index, &c. and portrait of Charles Vi
Esq., C. E., is just published, price 6*d.* Al
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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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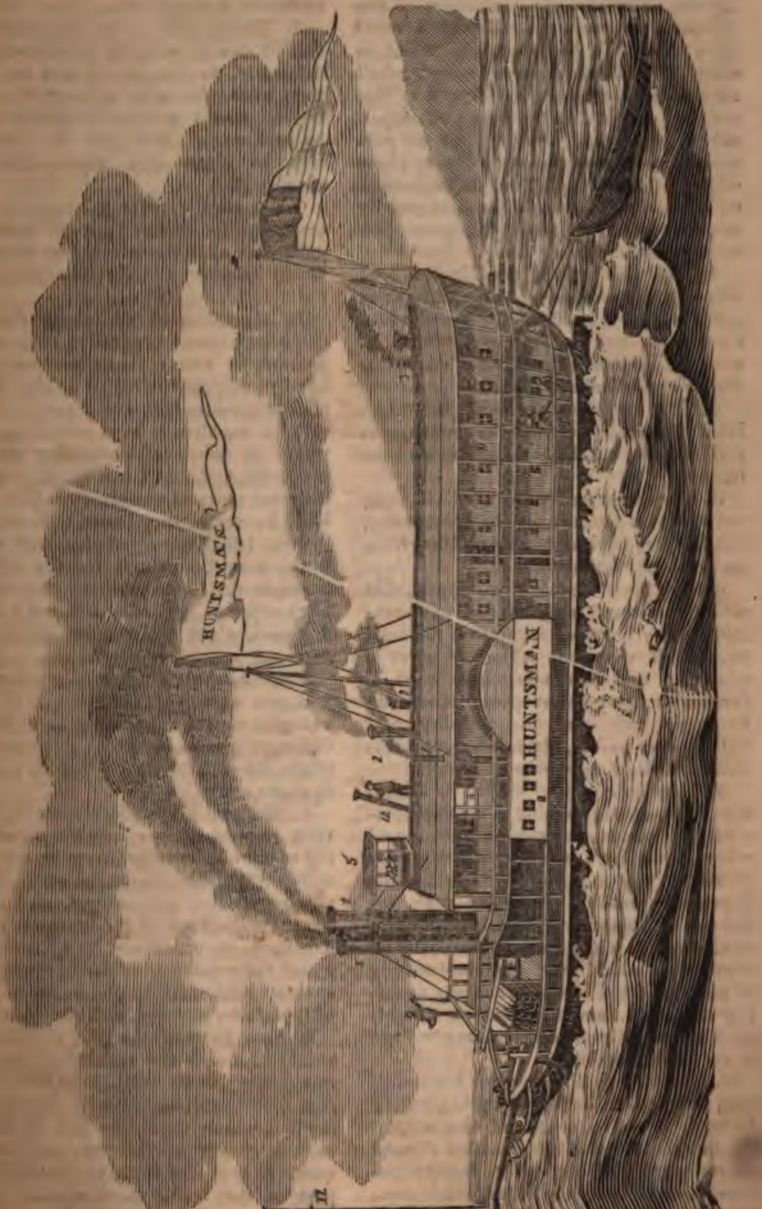

THE AMERICAN STEAMER, "HUNTSMAN."

SUGGESTIONS ON THE NAVIGATION OF THE ATLANTIC BY STEAM.

Sir,—I now proceed to fulfil my promise, of communicating the results of my cogitations on the navigation of the Atlantic by steamers. Before I enter upon the details of the system, which is essentially different from any in use, I shall state what I consider desiderata to this end, all of which I hope are obtained in the proposed plan, though I do not pretend to insinuate that I consider my plans so good that they may not be improved; on the contrary, I think them extremely imperfect, and, consequently, quite open to improvement.

1. The vessels to be used in this species of navigation to be made as light as possible, and to combine safety with sufficient room, and the least possible resistance to the water below load-line, and to the air or wind above that line.

2. That these vessels shall be calculated principally for carrying passengers, and to carry but little baggage, and no ballast.

3. That they be constructed of iron, not only on account of its great levity, but for the increased safety resulting from its non-combustibility.

4. That these vessels be so rigged, that all the masts and rigging can with ease and facility be taken in, so that the least wind draft will exist when the wind is adverse; and that when the wind is favourable, the greatest spread of sail can be made with ease and rapidity, and with perfect safety, though the vessel is without ballast, properly so called.

5. That material and weight be economised as much as possible in the composition of boilers, engine, ship's furniture and stores, boats, &c.; and that the necessity of taking any supply of water for the voyage be entirely dispensed with, by the use of a species of fuel, hereafter to be described, which will constantly by its combustion produce an abundant supply of pure, wholesome water, thereby avoiding the dead loss of so much freight, which in ships intended for a long voyage is very considerable.

6. That one paddle be used instead of two, which must be placed so that it may be in or near the centre of the motion of the whole mass, and thereby always nearer a grip of the water, though the *vessel herself may roll* and pitch *considerably*. The position, and arrangement, and construction of the paddle to be such, that it cannot be too deeply immersed in the water, so as to do little or no good, which is so often the case in our steamers in rough seas.

7. The paddle to be so constructed that it can be entirely withdrawn from the water, so that it will not be in the way, when the sails without the steam can be used: a practice which would be economical, and give the engineers time to clean and repair the machinery, &c.

These are the principal requisites necessary to be obtained; some minor peculiarities shall be glanced at hereafter, which being of a trifling character, need not here be insisted on.

In sketching or describing the machine by which I propose to navigate the Atlantic by steam, many seamen would not feel disposed to call it a ship. I shall merely premise that every part and parcel of it has already been proved by practice to be effective in attaining the end proposed, and that I merely put together different parts of machinery which everybody knows, or may know, to be actually in use. I shall not attempt to state which is the very best shape for the different parts, or their best possible proportions. My outline is general; it is not a working plan, which will require more heads than one to bring to perfection.

For the sake of preventing repetition and not occupying too much of your valuable space, I shall state in order the different means by which I propose to attain the ends to be desired, which are as above stated.

1. Material to insure greatest lightness with greatest safety. Iron for the sheathing of bottom, and also cover over the deck, which might be considered as an extension of the hull's sheathing, and would resemble the back of an immense turtle. The deck proper below this, and on to which the small cabins would open, to be covered with wooden planks, or if made of iron to be covered with cement.

a. Such parts of the iron sheathing as would be below the occasional wash of salt water to be well cemented. The iron below water-line to be coated with copper, which should be left to the dissolving power of the sea, and, consequently, kept free from contact with any part of the iron, which should in all places be well cemented.

b. The ribs and timbers of the vessel to be made of iron and wood, according to their nature and position; but in framing the vessel the greatest strength and elasticity of the parts to be attained.

c. The vessel should be double, like the double steamers at the ferry in New York, or double proas of the Ladrone Islands. The last is the model after which I propose that part of the vessel under water should be built. They would, consequently, carry their *greatest breadth under water*, and slope from that upwards, gently rounding, so that at a distance, when the wind was adverse, an elongated dome, like the back of a whale or tortoise, would be alone seen above the surface of the sea.

d. Such a shape as this described would oppose but little resistance to the wind, and least to the water.

e. And make accommodation for a very large paddle-wheel in the centre between the boats.

f. The crew and engine to be completely confined to one of the twin-boats; the other to be reserved for the exclusive use of the passengers, who might be allowed the recreation of a walk in fine weather on the ridge of the roof, the sides of which might be furnished with a temporary railing and netting. The roof to be furnished with ports or openings, bull's-eyes, &c., to admit light and air, and properly secured windows. These openings to be all closed on the weather side, when necessary.

g. The boats to be without keels, the flat sides of the opening between them, and in which the paddle works, being quite sufficient; or if not, lee-boards to be used when necessary, like those used by the Dutch galliots.

h. The bows of the vessels to be full, but not bluff, and to rise *quite perpendicular* above the water as high as the "bead" of the sea, or boil, as we landsmen call it, and that the bend of the roof should there begin. A sharpness in the bows, both above and under water, is necessary, but all *hollowing* of the parts should be avoided.

i. The two vessels to be firmly framed together, but no cross-timbers of the frame to be under the water-level. The transverse arch of the roof affords ample means for securing the two vessels perfectly safe in this respect. The arch of the *roof, extending from stem to stern* on the sides of the middle space, also offers every opportunity to the carpenter for framing, as it were, a double back-bone, or frame, on the flat side of each boat, which shall not only hold the paddle firmly in its place, but also the working cylinders of the engine, and effectually secure the machine from injury in "pitching," which otherwise might endanger the whole of the fabric.

k. The space between the boats to be as great as safety will permit, and the depth the least to which the hulls of each would sink. The first for the double purpose of affording the greatest breadth to the paddle, any also of giving greatest stability to the vessel when carrying sail, either before the wind, or on a wind, if the fire should fail, or any accident happen to the engine.

l. Vessels so constructed require two rudders, one of which is attached to each half, and both connected by a very simple contrivance, which makes them both act with equal effect.

m. The general proportions and bulk of a vessel of this construction will depend on the business expected to be carried on with her, and also on the capital people may feel disposed to risk in the speculation.

n. The roof to have an opening in it, through which masts could be elevated, and rigged schooner or lugger fashion. The butts of the masts to be each fixed in a moveable centre, firmly secured in the middle frame. Such would be the breadth of the deck, that the sheets would be quite sufficient to spread the sails; no "booms" would be necessary. Bowsprits could be easily run out; and the rest of the rigging, such as stays, run down through the roof, through proper openings, and all got to rights in little time. The lower leech of the sail, when hauled flat, would rest upon the roof, which would thus become a part and parcel of the sail.

Your nautical readers will readily understand these suggestions. In my next I will continue the subject, with your permission.

I send you herewith the drawing of the Huntsman steamer, which was by some neglect omitted in my former packet. 1 1 are the chimneys; 2, steam eduction-pipe; 33, cabin chimneys; 4, cooking-stove chimney; 5, steering-station; 6, ladies' cabin; 7, gentleman's cabin; 8, cook's house; 9, boilers; 10, fire-wood; 11, flag-staff used for steering by; 12, pipe from safety-valve.

Your well-wisher,
E. TALEBOIS.

Liverpool, Oct. 7, 1835.

PLANS FOR FREEING LEAKY SHIPS FROM WATER.

Sir,—In answer to the inquiry of N. G., in your 611th Number, I beg to offer a few observations upon freeing leaky ships from water.

The action in all the plans I before alluded to was derived from the motion of the vessel through the water. An apparatus on this principle may be made to work any description of pump; but it is no easy matter to select one of so simple a construction, that a captain of a vessel will be induced to provide himself with it whilst safe in port, however desirous he may be to possess it in time of danger.

As your correspondent thinks Archimedes' pump might be advantageously brought into use for the purpose, I will give it the first place for consideration. After placing it in its proper angle for working, either over the side or stern of the ship, the simplest and most convenient method of putting it into action would be by a water-screw, towed behind and acted upon by the ship's way. Should it be inconvenient at the time to make such a screw, a substitute might easily be made by any ship's carpenter, in a very short time, by taking a spare spar, and fitting at each end two sets of four short arms, as in windmills, properly weighted, so as to keep the alternate uppermost arms below the surface of the water, in order to give full effect to the rotary motion. It would perhaps be better to make the arms at the after-end longer than those at the fore-end, in order that the spar might tow straighter.

Whether such an apparatus were applied to the working of the common pumps as that of Archimedes, or any other, I should greatly prefer it to a paddle-wheel over the ship's side, which, besides being unsteady in action, from its inconstant immersion by the vessel's rolling, is not so simple nor so ready for use.

The water-screw has been used for sounding, measuring a vessel's velocity, and also proposed amongst the almost endless variety of methods for propelling vessels by steam; but I have never heard of its application for the present purpose. As the axis of an Archimedes' screw would be in a different direction to the tow-rope which towed the water-screw, two bevelled toothed-wheels would be necessary to work the pump; the powers and diameters of the respective wheels should be, of course, proportioned to that of the respective screws. Although it is not likely a captain would object to the bevelled wheels as an addition to the vessel's sea store, yet I think he could not be induced to encumber her with such a bulky concern as an Archimedes' screw, and it would be no easy matter to construct one in the hour of need; for this reason only I cannot agree with your correspondent in thinking that it might be advantageously adopted, it appearing to me that in makeshift plans that is always best which can be carried into effect with such means as the vessel already possesses. Therefore it is, that I would recommend her own pumps to be worked by a water-screw or its substitute.

But the rolling motion of the vessel must not be wholly neglected, for it might happen that a half-sinking ship might be tumbling about in a calm, or hove too, when no advantage could be taken of her way.

If a weighted pendulum be suspended in a ship, it is needless to say that the power would be, as its weight multiplied by the velocity of its motion, or rather the vessel's motion whilst it remains at comparative rest. At a first glance one would suppose great advantages attainable by this motive-power; but a very slight investigation soon proves the fallacy of such notions. If a man's power at the end of the pump-handle be taken at 30lbs., and he make 45 downward strokes in a minute in an arc of 90°, whilst a vessel rolls in one of 30° (a very liberal allowance), and makes 9 double rolls in the same time, then the weight at the end of the pendulum would be the power of 15 men, or 450lbs., employed to produce a man's power at the pump, ¼th of which, or 112lbs., must be added for friction, making the required weight 562lbs.

But this calculation is supposing the pump-handle and the pendulum to be equal in length from their respective fulcrums; of course, if the pendulum were double the length, then the weight necessary would be only one-half of 450lbs., and so on in any proportion between the two. To put this in practice, the pendulum should, by its cogged-wheel arc, put in motion a pinion, which, with or without other trains of wheels, as the case may be, should impart the necessary vertical motion to the pump-piston; but in the absence of wheel-work, the required motion may be obtained by means of an endless rope attached to the pendulum, led through blocks on each side of the vessel, and over a wooden axle, imparting quick motion to its wheel, which could transform it into a vertical one by a crank, or even by ropes should a crank be unattainable. This contrivance might be managed in a short time by suspending any spare spar from the main-mast, and loading its end for a pendulum, taking care to have guides to keep it from a pitching motion. Many ingenious methods have been proposed for propelling a vessel by her rolling motion; but what I have said of the great weight required to attain even a man's power will, I hope, show their fallacy, as it would require a pendulum to be weighted 100 tons to produce the power of 400 men (about the amount of a frigate's crew), or about 10 tons if the pendulum were as long as the main-mast-head above deck, either of which appendages would equally destroy the motive-power. Now, as the effort of a whole ship's crew can but propel her slowly, what hope can there be of gaining any effective force by her rolling, whatever may be the nature of the method devised? Suppose, for instance, long spars were used, rigged out on each side with inclined planes fixed to them to propel the vessel as they alternately dipped in the water, still the vessel would not roll sufficiently to produce any useful motion; and if the spars could be made very long, with deeper inclined planes, the same tendency to destroy the motive-power would be the consequence, as in the case of the long pendulum; *or if quicksilver* were tried, *the same result would follow*; in short, *unless the ship would be* civil enough to roll through an arc of 90° in double quick time, I cannot see any thing of consequence to be gained by her freaks. The only case in which any such plan would be ventured upon, would be that of a ship in a dead calm and a very heavy rolling sea, in the Bay of Biscay, wanting to come up with an enemy's ship *just out* of gun-shot, supposing both the respective ships' crews already to have done all in their power by their manual labour, the one to close and the other to get away.

I remain, Mr. Editor,
Your obedient servant,
⊕.

BRICK-PAVING.

Sir,—The plan of paving streets with bricks is one which has never been brought into extensive use, and to places where there is much traffic it is certainly not very suitable; but I cannot help thinking that there are many little frequented thoroughfares where it might be adopted with great advantage. A specimen of this paving, which may be seen in the Kingsland-road, appears to have answered tolerably well. At a school in Hackney there is a shed in the play-ground adjoining the school-room, the floor of which is brick paved, and is in very good condition, though it has now been laid down, I believe, upwards of twenty years, and daily trodden upon by from twenty to thirty boys. I recollect, also, a great portion of a yard before a farm-house at Shaftesbury which was paved with bricks (picked seconds and paviors), the different colours of which (owing to the diversity of the clays, &c. which compose the bricks) were ornamentally arranged, and had a very neat and agreeable appearance. In laying a brick-paving, the principal thing would be to have a firm bed of concrete, or any other strong substratum, upon which should be laid good mortar to receive the bricks; these might either be laid in straight courses, in circles, or other figures and designs, in infinite variety.

The bricks should be the best picked seconds, laid on edge, with a granite or other stone curb to bind the whole firmly together; in addition thereto, a thick coat of slacked lime, with a small quantity of sand (used in the same way as in the construction of London stone-roads), should be thrown over the surface, allowing it to remain a considerable time before used. The drains or gutters from the houses should be continued underneath the pavement, as the water-course would then be uninterrupted; and the coal-shoots should be worked in concentric circles at regular intervals, or a circular Yorkshire paving of requisite size might be inserted.

I am, Sir, yours, &c.
Frederick Lush.

Charles-square, Hoxton,
Dec. 12, 1835.

ON THE STATE OF THE ARTS OF DESIGN IN ENGLAND, WITH A POSTSCRIPT ON TAXIDERMY AND TRAVERTINO.

Sir,—Upon reading your judicious testimony before the Committee of the House of Commons on Arts and Manufactures, I was struck with a passage (p. 189, 642d No.) wherein you most appositely remark on the "wretched prints" and "still more wretched stucco images" with which this country is inundated by the itinerant *Italian* hawkers. A great portion of the plaister of Paris casts are good, and in good taste; but the prints are all, without exception, the most wretched that it is possible to conceive it possible to execute. Many of the plaister casts, too, are as bad as the prints; and your remarks on this head brought to my recollection a circumstance which tallies most opportunely with them.

Some ten years ago, walking in the country in company with a gentleman of extensive knowledge and the most correct taste, we met an Italian lad bearing his board of images, most of which were of that horrible sort of rubbish most prized in country places —all daubed with paint, red, yellow, blue, and black. My friend asked the Italian how he could possibly think of selling such *ugly* things, and how he could look on them without being sick? The Italian's reply exactly tallied with that which you, Mr. Editor, gave to the Committee:—"No doubt they consulted the taste of their customers." He said, "*Ugly* do you say? Yes, they are ugly; but some people's do like them for to be ugly!" and added, in *Italian, "In Londra, possiamo vendere le cose regolare; ma in campagna, ci vuole il colorato e barbaresco.*"—"In London we can sell the *regular* things; but here (in the country) we must have the coloured and barbarous." By-the-bye, I will remark, that the Italian did not mean to attach the epithet of "barbarous" to the coloured, merely as coloured; though I do not mean to say that he was actually aware of the fact of the ancients, both Greeks and Romans, painting the statues of their gods and goddesses to the natural hues, and clothing them in garments according to the most approved fashion of the day.

I should think that there can be little doubt but that the contemplation of, and the drawing from, good statues or casts is far more efficacious in infusing a right knowledge of design into the student, as well as good taste and judgment in the public, than engravings, drawings, or paintings, can possibly be. I mean, that *cæteris paribus*, the diffusion of good statues or casts will have a far greater effect in a community than an equal diffusion of engravings and paintings. The *facilities*, however, which occur in the dissemination of the latter, through the innumerable publications which are now accompanied by wood-cuts or superior engravings, must give it the lead in the power of general instruction to a community.

Speaking of castings in plaster of Paris, I will mention a circumstance which, I dare say, most of your readers will feel aware of, which is, the very imperfect representations of fishes exhibited in museums and collections of natural history, when the stuffed skins of the animals are given as something like unto the originals. When we look upon the stuffed and varnished skin of fishes we have never seen alive or dead, the faults in the representations do not strike us; but let any one look at the preserved specimens of cod, soles, salmon, pike, trout, &c., with the very *physiognomy* of which he is quite familiar, and he will surely require the aid of the name affixed to the specimen in order to recognise his old acquaintance! Not one of the stuffed fishes of the collections bear any greater resemblance to the real animals, than a stocking stuffed with hay or wool would have any anatomical resemblance to the leg of a human being! The transformations of the stuffer are truly ludicrous.

But it is not his fault; it is the *process* which is entirely inadequate to the purpose. Birds, and some animals with long hair, such as bears, &c., may be tolerably well represented through the art of stuffing, &c. But has any one seen a stuffed horse? I have, at Paris and elsewhere; and, unfortunately, our eyes are so familiar to the "noble presence," and to every beautiful swell and turn of the limbs and muscles of that noble animal, that the specimens I allude to, although executed by the first artists of the line in the world, might almost be mistaken for apes, or even cows, but for want of the ears and horns! But I am too prolix in the introduction of the trifle I have to present to such of your readers as are fond of fish and fishing, which has been my only diversion for many years. I have been in the habit of catching pike of 10, 12, and 20 lbs. weight; trout of 7, 10, and 11lbs.; and in Italy, fish of much larger size. I was for some time in the habit of preserving a drawing of the best fish, by laying them on paper and taking the outline, an exact fac-simile as far as that went. I then attempted to stuff some of them, but succeeded no better than the gentlemen of the museums. I then thought of taking a cast in plaster of Paris of the fish, which I executed in more ways than one, all equally satisfactory. First, I took a cast of the fish, and then saturated it with linseed oil, and painted it from nature, so as to be, to all intents and purposes, a fac-simile. Secondly, I skinned the fish, took a cast, and then drew the skin over the cast. Thirdly, I made the cast from the unskinned fish, then skinned it, and drew the skin over the cast. The only difficulty I had was with the skin of the head, but that is of no consequence, and it might be overcome after three days' application. But by painting the cast the most perfect fac-simile is produced, both in form and colour; and the latter will not be liable to the changes and blackening which occurs to the varnished skins of fishes.

I fear that you will accuse me of occupying your valuable columns with much trivial matter; but as far as the preservation, or rather *representation*, of fishes and *reptiles is worthy of consideration, I think that the* "*preservers*" will be benefitted by this communication.

Another word or two on a subject connected with the preservation of stone and roofs, &c. The stone of which the Church of St. Peter's, at Rome, is constructed, is a calcareous, stalictitious stone, called Travertino, formed by an agglomeration of bushes, leaves, roots, and some shells, by means of a calcareous fluid by which the whole is fossilised. The very process of this formation may be observed in all its various stages of progression and completion on the road to Tivoli, about twelve miles from Rome. This is an interesting topic, but I must only allude to it in order to introduce the Travertino, which I have to represent as rather liable to honeycombs. These honeycombs, when they occurred in the surface of any of the steps, copings, terraces, &c., on the vast surface of the top of St. Peter's Church, were usually filled with melted pitch or some kind of cement; but the great heat of the sun, combined with the action of the air and water, soon melted, decomposed, and dissipated these fillings in. In 1804, I recommended the application of melted sulphur into all honeycombs, cracks, crevices, and junctions in the stone or clinkers which constitute the top and pavements of St. Peter's Church, which, in extent and appearance, is very much like a small town or fortress. The sulphur was universally applied; and up to 1815, I had frequent ocular proofs that it was no more affected by the sun or atmosphere, than would have been so much pure gold. To this I will only add, that from subsequent experiments I have found, that by the addition to the sulphur of a small quantity of iron filings, a very hard sulphuret of iron, or artificial pyrites, is produced. Copper, or brass filings would probably produce an analogous result.

I have read with very great satisfaction, in your last Number, Mr. Thomas S. Mackintosh's Electrical Theory of the Universe, to which I take the liberty of soliciting the particular attention of your philosophical readers. I shall venture to offer some remarks upon it next week. Meantime, I have the honour to be, Sir, your obedient servant,

F. MACERONI.

SELECT COMMITTEE ON ACCIDENTS IN MINES.

Extracts from the Minutes of Evidence.

[We gave in our last Number the Report of the Committee of the House of Commons on this deeply-interesting subject, and shall now proceed to extract those parts of the evidence which are more particularly referred to by the Committee, as furnishing the reasons for the conclusions at which they have arrived.—Ed. M. M.]

James John Wilkinson, Esq., examined:

Have you for some years taken a lively interest in the working of coal mines, in the northern parts of this kingdom?—Yes; in the calamitous accidents which have arisen in the working of coal mines.

Are you one of the original members, if not the original proposer, of a society for preventing accidents in coal mines, in the county of Durham?—I was the original proposer of that society.

Can you give the Committee any information relative to the objects of their inquiry?—On the 25th of May, 1812, an accident happened at Felling, near Gateshead, in which ninety-two persons suffered. I was particularly struck with this very afflicting accident, and the more so, from a circumstance which I am sure will have its due effect upon the Committee, and that was this, that after ninety, if not the whole, of the sufferers had been taken out of the mine, and on a particular day, the coffin of what may be called the first of the sufferers began the procession, which increased before it got to the church until it amounted to a procession of ninety coffins, with mourners; this struck me particularly, and I thought if this could possibly be remedied, it would be doing a great good to society. I went into the north of England in the long vacation of 1813, and I consulted many of my friends, and the result was, that I considered it my duty to call the attention of the public to these accidents, to have a full investigation into the whole subject, and to see if any remedy could be applied. On the 1st of September, 1813, I published, and sent into Durham and Northumberland, proposals for a society for preventing accidents in coal mines; this was circulated by letters, &c., very extensively, and among the rest came to the notice of the late Bishop of Durham; his lordship wrote to the late Dr. Gray, afterwards Bishop of Bristol, to say that he gave Dr. Gray a *carte blanche* to do any thing *that might be necessary* in the formation of *such a society*. After consulting with many of my friends, with Sir Ralph Millbanke; and Dr. Gray, and Dr. Clanny, on the 27th of September, 1813, was published a handbill for a public meeting for the establishment of the society at Sunderland, and on the 1st of October, 1813, the meeting was actually held at Sunderland, Sir Ralph Millbanke in the chair, in which a committee was appointed, and I had the honour of receiving the thanks of the society for having suggested the plan of the society. The Committee began its meetings, and received a variety of communications, and one, which I beg to call the attention of the Committee to, was a communication from Mr. William Chapman, now deceased, the celebrated civil engineer, on the causes of frequent explosions of inflammable gas. In November, 1813, the society published its first report, which I beg to lay upon the table. (*The Witness delivered in the report, which was laid upon the table.*) That report contained a preface, stating that their funds were small, and that they had received several communications, and among the rest a very valuable letter from Mr. Buddle, which forms the basis of their first report. It was soon ascertained that the townships and parishes were extremely negligent in calling upon the coroners in cases of accidents, and Dr. Gray spoke to the magistrates, and the consequence was a charge at the sessions, which brought on a better system; and by Sir John Bayley also, a charge at the assizes, which contributed to the like effect. It was thought advisable to apply to Sir Humphrey Davy, and I called at the Royal Institution on Sir Humphrey Davy, but he had gone to Paris; I put a letter into the post-office for him, but not having paid the foreign postage, it was returned to Mr. Burn, the secretary of the society. In 1815, Dr Gray was requested to write to Sir Humphrey Davy, as chairman of the Committee, to interest himself in the cause; and Sir Humphrey Davy came into the North either in August or September, 1815, and met several of the gentlemen of the Committee, and others, at Dr. Gray's. Sir Humphrey Davy afterwards saw Dr. Clanny and his lamps, and, I am persuaded, derived considerable advantage from them. Sir Humphrey Davy's lamp came out in 1816. I am sorry to state that the society received very little support or funds from the coal-owners, but I am glad to state that there was a greater vigilance in working coal mines, and a better system; that fewer accidents happened; and I am persuaded many valuable lives preserved to their families and their country. Mr. Buddle's pamphlet was a valuable addition, both to the miners and to science. Sir Humphrey Davy's and Mr. Stephenson's lamps also contributed to reduce those accidents. I believe much remains now still to be done. The accidents in coal mines may arise from improper working, as to which I beg to refer the Committee to Mr. Buddle's letter, in our first report. During the time that the society was in activity, a person of the name of Ryan, from Ireland, came to the society with a new system of ventilation, the object of which was to do away almost entirely with the braticing and boarding of what may be called the old system, but Mr. Ryan's plan did not succeed. Another system of working will be explained to the Committee by Mr. Martin. Accidents may also arise from improper ventilation. I beg to refer the Committee to the plans of ventilation mentioned by Mr. Buddle, in our first report, by a furnace, page 6; by a water-wheel, page 6; by a hot cylinder, page 7; by air-pumps, page 7; and by air-coursing, page 17; and also to the defects of the system, in page 21. After the ventilation comes the system of light to the miner; and I beg to refer the Committee to light by candles, mentioned by Mr. Buddle in our report, page 18; by the steel-mill, in page 20; then come the different lamps. The first lamps in priority are Dr. Clanny's, who has been the inventor of several, and has been an indefatigable labourer, but, I am sorry to say, has received no reward. Sir Humphrey Davy's is a beautiful invention, and a great improvement, and did great good; but on inquiry in the North of England, I believe it is liable to accidents by pieces of coal, by the stour, particles of coal-dust, settling on the meshes, and by sudden blowers of gas; and I think it would be improved if there were a rim which would keep what we call the stour in the north, the dusty atmosphere, from descending upon the gauze; and if the upper part of the gauze was made in the shape of an inverted cone, the dust would be less liable to settle. Sir Humphrey Davy's lamp, in my opinion, has suffered from the indiscreet zeal of his friends in not allowing it to be an imperfect instrument, or rather in insisting that it is completely perfect. It was soon ascertained, I believe, that Sir Humphrey Davy's lamp wanted a sufficient light, and a reflector was added to it; whether it is now used or not in collieries, I am not aware. With Sir Humphrey Davy's lamp ought to be mentioned Mr. Stephenson's, another valuable addition to coal mines, on a similar principle; there is a dispute as to priority between Sir Humphrey Davy and Mr. Stephenson. I now come to another subject of considerable importance in working mines, which has already been mentioned to the Committee, and that is the *danger that arises from breaking into old workings or wastes.* This occasioned the *dreadful accident at Heaton*, and for preventing this in future, I beg to present to the Committee two pamphlets by Mr. Thomas and Mr. William Chapman, on the propriety of having maps of all the workings of coal mines. I beg leave also to call the attention of the Committee to the lead mines, and to express my opinion that cleanliness must add considerably to the health of that body of miners, who suffer much in their health.

Mr. Nicholas Wood, examined:

Are you engaged professionally as a collier-viewer in some of the largest collieries in the counties of Northumberland and Durham?—Yes; I am viewer for Lord Ravensworth and partners' collieries, and I am engaged in Gateshead Park and Tyne Main collieries.

Are you the author of a work that has been given to the public on railroads?—I am.

Will you have the goodness to state to the Committee your idea of the coal stratifications of the North of England, as productive of carburetted hydrogen gas?—The coal in the North of England generally lies in seams, varying from three feet to six feet in thickness; it consists of different varieties of coal, some considerably more bituminous than others, which may, perhaps, be classed into bituminous or caking coal, and slaty, or coal that does not cake.

Do you consider the bituminous or caking coal, or the slaty, to generate greater quantities of carburetted hydrogen gas?—The bituminous coal.

Are those stratifications liable to interruptions or dislocations?—To considerable dislocations and interruptions, both in number and extent.

Have you ever observed a greater or less generation of carburetted hydrogen, where those interruptions or dislocations take place?—In answering that question, I do not know whether it would not be necessary to enter into an explanation of the manner in which the gas exists in the coal, in the first instance, and then to point out the way in which those dikes and slips affect that gas, and bring it in contact with the miner, in the operation of working the coal.

The Committee wish you to proceed to give your opinion of how the carburetted hydrogen gas is suspended in the coal stratification, and the alterations which take place in consequence of those disruptions and dislocations?—In the operation of working the coal, we find in practice a continual hissing sort of noise in the coal, especially where it abounds very much with inflammable gas. Lately, by means of cutting coal into very thin slices, and magnifying those slices, it has been ascertained that the coal is very porous, and that those pores contain bitumen distinct from the chemical composition of the coal itself; and in those pores also, I believe, the gas is contained, either in a state of very high compression, or it has been surmised that it exists in a liquid state, which contains a still greater quantity in a smaller bulk. I have brought sketches of some of those coals that have been sliced and highly magnified, to enable the Committee to observe the nature and appearance of those pores. The very dark appearance in these specimens is the bitumen supposed to be in the cavities, and the round spots are the cavities where it is supposed the gas exists. This mode of examining the structure of coal was an invention of Mr. Witham's.

[*The Witness produced the drawings, which were inspected by the Committee.*]

The Committee observe, that upon these sketches are certain numbers; are those the numbers by which you are familiar with the different specimens here pourtrayed?—Yes.

Will you, in the course of your examination, allude specifically to the drawings by their number, and describe them in succession?—I can do so; I should observe, that these drawings which I exhibit are from a paper read by Mr. Hutton, of Newcastle-upon-Tyne, which has not been published, but which, I understand from him, he intends to publish shortly,

Do you suppose that there would be any objection to copies of these drawings being made, in furtherance of the object of this inquiry?—I should think not.

The Committee understand these drawings to be correct copies of the appearance of certain portions of coal, sliced as you have described, when submitted to a strong magnifying power?—Mr. Hutton stated them to me to be correct copies.

Will you have the goodness to proceed to describe each drawing separately, and in numerical order?—It must be observed, that the description I give is from reading the paper of Mr. Hutton, not from my own knowledge. This drawing, No. 1, is stated to be a slice of a coal from Heaton colliery, in Northumberland; and the appearances show that that coal contains a considerable number of pores, and that coal is a very bituminous coal, yielding a considerable quantity of gas.

Do you find quantities of gas in proportion to the size and number of cavities?—The experiments have not been sufficiently numerous to establish that fact. No. 2 is a specimen of slaty coal, in which the cavities are almost entirely extinct; and this is a coal that does not yield much gas, if any. No. 3 is a specimen of cannell or splint coal, *in which there are very few pores*; and I be*lieve that* cannell coal does not evolve any thing like the quantity of gas that the No. 1 does.

Do you know from what mine the specimen of cannell coal is taken?—I do not. No. 4 is a specimen of anthracite or stone-coal, from South Wales, in which there are a considerable number of pores; and I know, from my own experience, that that coal in some mines produces a considerable quantity of gas. This porosity of the coal, I think, corroborates what we find in experience in working the mines: in the course of working, we find the gas issue from innumerable pores over the whole surface of the excavation; that is one mode in which the gas is evolved in the mine, and the force with which it is evolved depends very much upon the depth of the mine, and other circumstances respecting the dikes that I have mentioned as crossing the coal strata almost in every direction. I have a working plan of Killingworth colliery here, which will at once explain to the Committee the dikes which have been met with in that colliery.

[*The Witness produced the plan, which was inspected by the Committee.*]

The lines on the plan that you produce, the Committee understand to designate those interruptions in the coal stratifications of which you have already spoken?—Yes.

Some of those throw the seams of coal to a higher and some to a lower level, as regards the surface of the earth?—They do.

What is the size of this mine?—This plan is four chains to an inch, and the workings cover about 800 acres, worked by two pits.

In addition to the emission of gas, in consequence of the porosity of the coal to which you have alluded, do you ever find considerable escapes of gas from the roof, or from the floor or thill of the seam?—We do.

What is the nature of the roof or thill in the mine to which you have alluded?—The nature of the roof varies considerably. Having spoken of the gas being produced by those pores, the slip-dikes, which are cracks in the strata, are sometimes filled up entirely, and sometimes they are not; the whole strata consists of alternate layers of sandstone and shale; where the shales abut against each other on the two sides of the dike, the dike is filled up entirely; but where the sandstone abuts against sandstone, there are very often cavities in the line of those dikes; those slip-dikes, then, act as tubes or pipes to collect and convey the gas extricated from the coal to great distances. The gas is extricated from the coal into these cavities in the dikes, and they convey the gas as gas-pipes to different parts of the coal-field. When one of those dikes is met with in the working, independently of having to contend against the extrication of the gas in the coal itself, the gas in the slip-dikes is thrown out in very considerable quantities; and as those fissures in the slip-dikes are generally narrow, and the gas comes out in a small space, it often issues with great force, and is then known by the term "blowers," and the size of the cavity and the degree of pressure to which the gas within is subjected, regulate the force at which it issues from that blower. I have mentioned already that the coal strata consists of sandstone and shale; sometimes the immediate cover or roof of the coal is sandstone, and sometimes shale. The shale is very compact and quite impervious to the air; and in coal-working, where the roof is shale, there is no discharge of gas from the roof, it entirely exists in the coal itself, unless any break of the strata is produced by accidental causes, and a communication is made with the more porous roof, or with one of those slips that I have mentioned. In several instances the roof of the coal is sandstone, and sandstone being more porous, and having more fissures in it, the gas in that sort of roof is more liable to be discharged from the sandstone than from the roof of shale. The same takes place with respect to the thill of the coal. Seams of coal very often have thinner seams near to them, below or above; if the thill of the coal be shale, it is only when that shale is broken through, and a communication is thus made with the lower beds of coal, which is often the case in practice, that, as before stated, independent of the supply o gas from the seam which is working, the additional supply of gas from the scam underneath is encountered; and I would observe that this is peculiarly the case in working pillars, the coal being entirely taken away, the thill is more liable to lift up and communicate with the lower seam than in the whole coal-working. This likewise occurs in cases where the original pillars have not been left sufficient to support the incumbent strata; when this is the case, what is called a creep takes place, which is the act of the thill or floor of the mine being lifted up, or the superincumbent strata pressing the pillars into the thill of the mine, which is thrown up, the floor is thus cracked, and communicates with the lower seams; there is, in consequence, an extra discharge of gas from the lower seams.

Then, in working the coal mine, a blower may be discovered either from the face of the coal in progress of being wrought from the roof, or from the thill or floor?—In all those cases we meet with them. Besides those that I have mentioned, the coal itself consists of divisions, or a sort of separation, which is termed backs, *and which are very frequent in some mines: by a back, I mean a* sort of division in the coal; in some cases it is simply a division without any other phenomena. In other cases there is a piece of bad coal between the sides of the crack; but those backs generally do not either elevate or depress the coal, they are merely cracks in the coal itself.

And those backs also form magazines of gas of larger or smaller extent?—The backs themselves do not form a magazine, but the coal is more easily separated in those places than in the solid coal. In approaching one of those backs the pressure of the gas throws off a portion of the coal adjoining it, and the gas is consequently discharged in much greater quantities than if it was a solid mass of coal.

And a greater emission of gas frequently ensues?—Yes; that occurs in some cases to such an extent, as I believe has been termed by Mr. Buddle bags of gas, being thrown out in the coal.

What do you understand him to mean by the term bags of gas?—A bag of gas is probably some cavity filled with gas, either in the coal itself, or near to it; and so far as my own experience goes, they are generally found in the vicinity of those backs; I do not mean by bag that it is a large open cavity, but gas highly compressed, throwing out the coal, though Mr. Buddle states some instances in which it has been found in large bags; but I do not know that from my own experience.

This you understand to be gas evolved from the coal, confined in spaces of larger or smaller magnitude, according to the nature of such backs?—I do.

You have been describing the effect of a thrust which breaks the thill, causing a sudden outburst of gas collected below, where the thill was composed of shale; in your judgment is it more dangerous to work a mine where the thill is of shale, and liable to those sudden outbursts, than when it is of sandstone, and the gas is perpetually filtering through?—I think more sudden bursts of gas occur in shale than when it is of sandstone; but I cannot speak at present of any instance that I know where the thill is of so porous a nature as to allow the escape of gas through it.

Even when it is of sandstone?—Where the thill is of sandstone, the sandstone itself is not of that gritty nature to allow the escape of gas through it.

You mentioned that you frequently met with collections of gas in the slip-dikes, which act as gas-pipes to convey the gas for considerable distances; as you approach the slip-dike, is there any indication of one being in the neighbourhood, by any disorder of the strata?—In several cases, in approaching a dike, the coal is more tender; but in a great many cases there is no indication whatever till you meet with those dikes.

Is it the practice of the miners, where they do observe an indication of that kind, to use extra caution with their lights, for fear of coming upon a slip-dike?—It is always the practice, where any indication is shown, that they are likely to come against a slip-dike, for extra precaution to be shown; and I will refer to the mode of doing so afterwards, on the subject of ventilation.

Will you have the goodness to state to the Committee what are the different descriptions of gas, according to their chemical definitions, which are met with in working those seams of coal?—The first description of gas I would mention is the carburetted hydrogen, which is the fire-damp of the coal-mines.

Do you consider that you have already sufficiently explained to the Committee your idea as to how this gas is evolved in the working of the mines?—I think I have.

Is there any other sort in addition to the carburetted hydrogen?—The carbonic acid gas is the next description of gas which is met with.

Under what circumstances is carbonic acid gas met with in the mines?—Carbonic acid gas is of much more specific gravity than the carburetted hydrogen, and it is found in the floors of mines; its existence is seen in the floor of the mine first. I cannot account for the manner in which it is produced; it is found in old workings more frequently than in any other case. In coal workings it is very seldom found, unless those workings have some connexion with very old workings; and in large wastes, and in old workings, it comes pouring out in very extraordinary quantities, and, in some instances, in a most unaccountable way; but this gas is not inflammable.

Have you ever met with it in such quantities as to impede the working, or injure the miners in their pursuits?—I have; I have met with it in such quantities that the candles would not burn in it; but the miners are not injured by it till a considerable time after the candles are extinguished.

Of course the miners withdraw upon their lights being extinguished by the emission of carbonic acid gas?—They are obliged to withdraw till this gas is drawn off, either by ventilation or by some other mode.

What other mode?—A fall in the barometer occasions a considerable change in the quantity of this gas discharged; if the barometer rises, the gas then withdraws to the old workings, and does not come out in such quantities.

As the pressure of the atmosphere increases or decreases, the emission of gas is more or less copious?—Yes, and the direction of the wind has in some cases an influence upon it, without a fall in the barometer.

Is not that gas much heavier than atmospheric air?—It is.

Have you ever known any mines so liable to the effusion of carbonic acid gas as to be prejudicial to men working in an inferior light, in the combination that takes place between atmospheric air and that gas?—I think if a man was to remain in it for any great length of time after the candles are extinguished, it must injure his health; but I have not had any complaints in the ordinary working of collieries infested with this gas. I have the charge of a colliery where considerable quantities of it are discharged occasionally; I have been myself in it when the candles would not burn, and I must say that I should not like to remain in it any length of time after such an occurrence. I do not think that the men could, without injury, remain very long in it, but the men are never obliged to work at those times; in some cases the working is suspended till the candles will burn freely, which they will do even with a considerable quantity of that gas. I think the health of the men is not injured, I would not say at all, but not materially, in working such collieries.

You are not aware of their complaining, that although the quantity of foul air of this description is so great as to injure their light, they have continued their workings under circumstances unfavourable to their health?—I have never known an instance of their refusing to go to work where they were desired to go, in such cases the practice being not to enforce the working where it was injurious to them.

You never enforce the working in those cases, if any objection is made?—We do not.

You state, that the production of carbonic acid gas is effected by a change in the wind, or a rise or fall in the barometer; is the production of carburetted hydrogen in the same way affected?—Yes, more so than the carbonic acid gas, as being of lighter specific gravity. As I stated before, it exists in those pores of the coal in a state of high compression; if the external pressure is removed, the balance is further destroyed, it issues in greater quantities, and we accordingly find a very much greater discharge, by the fall of the barometer.

Have you never known the carbonic acid gas emitted in such quantities as to produce an immediate sense of suffocation, or fainting, among the workmen?—No, never; I think that the light being put out a considerable time before it injures the workmen, guards against any danger of that kind.

Do you ever find it emitted from the fresh coal, or only when you get to old workings? —I myself know no instance of that gas being emitted from the fresh coal.

Has not the effect of an explosion of fire-damp to produce water, to consume the oxygen, and to leave the carbonic acid gas? —The effect of an explosion is to produce gas nearly of that nature; but where I am speaking of at present, and where the mines are most addicted to that sort of gas, there is very little, and, in the greatest majority of instances, no inflammable air. I would observe, that the gas, after an explosion, is not precisely of the same chemical nature as the carbonic acid gas; there is a great quantity of azotic gas in the mine after explosions.

But you have not observed it, in point of fact, except in old workings?—Only in old workings.

Is it the practice of professional gentlemen, in your situation, to descend old shafts into abandoned mines, and have you ever in those cases met with the carbonic acid gas in such quantities as to prevent the attempt so to descend?—In a great many cases I have; I have been interrupted in the course of working by the quantity of that gas, and also in getting down old shafts from the same cause.

In old workings, in which the air-coursing is destroyed, or completely damaged, have you any simple means of expelling the carbonic acid gas to enable you, or the workmen under you, to descend with safety?—The only mode we have of expelling the gas is to carry it off by ventilation, or by mixing the atmospheric air with it.

Do you ever meet with sulphuretted hydrogen in the course of mining?—I have met with a gas, which I suppose to be sulphuretted hydrogen, or that gas in combination with carbonic oxide, in the Tyne Main colliery, which is the only case where I have a personal knowledge of the existence of such a gas, though I have heard of men being destroyed with a gas, which I suppose must have been of the same kind; I have not had it analysed, but I think it is sulphuretted hydrogen mixed with carbonic oxide, from the smell, and from the sides of the old working containing incrustations of sulphur. This gas is of a very peculiar nature, the very reverse of the carbonic acid gas; in this a candle will burn and life is destroyed: I have been in it myself and have felt the effects of it, to a certain extent. It occurred in a situation of a mine where the men could go into it and come out at pleasure; the effect is felt upon the chest, and it ultimately destroys human life, though during the whole of the time, and until after life is extinct, the candle burns very brilliantly.

What *are the immediate indications* of the presence of sulphuretted hydrogen, such as would be observed by practical workmen? —The first indication is a difficulty of breathing, the candle does not exhibit any appearance that would show the existence of it.

Would not the lamp or the candle immediately indicate the presence of sulphuretted hydrogen?—I could see no indication in the candle that I had.

Under what circumstances would that ignition, which you describe as leading to fatal consequences, take place?—There is no ignition, but it produces suffocation; it affects the chest first, and destroys life by difficulty of breathing, or by spasmodic affections.

Will you give the Committee any instance in which human life has been lost through the agency of this gas?—At the colliery that I mentioned, the Tyne Main, I know instances of men being rendered insensible, that is, they dropped down and were dragged out by other men; but I do not know any instance, within my own knowledge, of human life having been destroyed by it. I have heard of a case at Hartley colliery, if I am at liberty to mention that which has not come under my own observation.

The Committee will be glad to hear any facts which you apprehend you have received from thoroughly authentic sources?—The case to which I allude I heard from the viewer of Hartley colliery, Mr. Jebling, it was a parallel case to Tyne Main. At Tyne Main it occurred where an old waste had been drowned, and in Hartley it was a similar situation. The men were approaching the waste and boring to ascertain its existence, they met with the water, and the water and this air issuing through this hole suffocated the person that was working, and the other men that went to his assistance found the candle burning close to where he was lying dead, and they had very great difficulty to get the body out of the place until it was properly ventilated; I have no doubt that this case proved fatal from the circumstance of the candle continuing burning, and the man knowing that the other gases showed some indication upon the candle before it was fatal to human life, that he thought that he was quite safe in working so long as the candle burned.

This was a case in which the sudden eruption of sulphuretted hydrogen was fatal to human existence, though not indicated by any change in ignition?—It was.

Have you observed the appearance of the candle burning in such gas?—I have.

Is there any indication in it of the existence of the gas?—None that I think would operate as a caution to the miner.

Is there no indication in the colour of the flame?—There is a greater brilliancy of flame, I think, but not to such an extent as can be considered in any degree an indication of danger.

Are there any other instances similar to this that you have mentioned?—I do not recollect any other instances; I believe the instances are very few indeed.

The Committee understand you to state, that you are not aware of this gas having been analyzed by any professional chemist?—I am not aware that it has.

But the consequences which you have described confirm your impression, in addition to that of the smell, that it is sulphuretted hydrogen?—Yes; the existence of sulphur in that place, and the smell itself, is what leads me to believe that it is sulphuretted hydrogen, but I think a considerable quantity of carbonic acid gas is in combination with it.

Is there no combination of hydrogen that could produce that effect?—I think sulphur is one of the parts of it; I would not state what the other is; I think hydrogen and carbon is the other, and perhaps I may have been led to that supposition, by having read that sulphuretted hydrogen, in certain combinations with other gases, does extinguish life, and yet not put out lights.

Do you think that it would be an instantaneous destruction of life, or would not the man be aware of some circumstance which would lead him to escape, if he could?—The first effect that arises is a sort of spasm in the throat, a sort of catching of the breath, that is the first effect that you feel; then you feel a pressure on the chest, which increases, and the difficulty of breathing, and which would be a sufficient indication for him to retire.

Do you think the effects would be so sudden as to deprive the person of the power of leaving the place in which he happened to be?—I think wherever this gas exists it is not dangerous. I think a man, with sufficient precaution, feeling the difficulty of breathing, may withdraw from it before he is destroyed.

Do you think, in the case to which you are referring, under the symptoms which are exhibited, the man would not have endeavoured to make his escape?—In that case it was a very peculiar one, it was tapping an old waste, where the gas came off very quickly, and I have no doubt that the man would be destroyed before he had any opportunity of reflecting on his situation, as regarded the effect of that gas.

You stated that in boring the old waste, the water and gas escaped together?—I did.

You have explained to the Committee the way in which the gas is extricated from the coal; you have described what the various gases are which endanger human existence, and impede mining; will you give the Committee an idea of the means which have been most successfully used by yourself, or other eminent viewers, to dislodge those gases from the coal mines in the north of England?—I should state, generally, that the only means we have is by carrying off these gases mechanically by a current of atmospheric air, and that current of air is produced in almost every instance by the operation of a furnace.

Do you produce a drawing of a furnace, such as is ordinarily in use in the mines in the north of England?—I do.

[*The Witness produced the same, which was inspected by the Committee.*]

Will you explain the uses and advantages of the furnace so used?—The use of a furnace is to heat the air passing over it, and by its rarefaction to produce a current in the mine; the furnace is placed near the bottom of one of the shafts, or the division of a shaft. Perhaps I should first mention, that in some cases there are two distinct pits to a colliery, in one of which the air descends, and in the other it ascends. In other instances there is only one pit, which is divided by a partition, or what is termed bratice.

In the case of a bratice pit, one side of the bratice forming the downward current of air, and the other the upward current of air?—Yes.

And the bratice is a wooden partition carried to the bottom of the shaft?—It is a wooden partition carried from the top to the bottom of the shaft, and is always made double.

Will you give the Committee an idea of the size, in square feet, of a furnace, such as you would think necessary for a mine of considerable extent?—I would observe, the size of a furnace depends very much upon the extent of the mine to be ventilated; the ordinary furnace is about six to eight feet wide, and about the same length. Where the mines are extensive, and require a larger furnace than that, two furnaces are placed at the bottom of the shaft.

Are those constantly supplied with fuel throughout the twenty-four hours?—They are, and men are kept constantly to attend upon them to feed them, so as to keep up as equable a heat, and as great a current of air as possible.

Have you ever known any instance in which an air-pump has been used as an auxiliary in extracting foul air, or in forcing a current of fresh air?—I have seen it in use, but have never used one myself. I have made some calculation of the power of the furnace in ventilating mines, and the principle on which it acts.

(To be continued.)

GALLOWAY'S PATENT PADDLE-WHEEL.

Sir,—Mr. Galloway in the construction of his wheel has assumed that the paddles will form a cycloidal curve in their passage through the water, and an advantage thus be gained by each rib of the float-boards following in the wake of the other. Were the water at rest, (neither flowing with the vessel nor against it), and the vessel travelling at the same speed as that at which the wheels revolve, then the cycloidal curve might be produced; but even that is an assumption which wants proof. Mr. Galloway has only taken into account the vessel's motion, and that erroneously calculated as equal to the velocity of the wheels, and has left the tide (either for or against) out of the question; and I can assure Mr. Galloway it will tarry for no man—not even for him nor for his wheels.

The inventor seems also to have overlooked the consideration, that a square inch, forming a part of a small surface, will not offer resistance equal to that of a square inch forming part of a larger surface; the property of fluid bodies being, that when one particle is struck, that particle strikes another, and another until some way of escape is found from the propelling or striking body. Therefore, a body of water will possess in a greater degree the nature of a solid resisting medium when struck with a certain, compact superficies, than when struck with same total, but divided, surface. This effect is, of course, in proportion to the distance between the portions of the total surface and the size of each of these portions. Mr Galloway, by dividing the paddle into bars or slips, therefore makes avenues for the escape of that which for the propulsion of the vessel it is an object to take hold of. It may be answered, that this law of fluids has not time to come into operation in consequence of the velocity of the wheel; but if this be the case, then is the new wheel worse than useless, in consequence of the immense back-water it would produce; because in such case the cycloidal paddles would act like so many buckets, each upon its emersion lifting a quantity of water according to its dimensions, the velocity not giving time for any escape between *the interstices, and throwing it out when the* cycloidal curved buckets become reversed; and perhaps not then, for it is not impossible that the wheel might attain a velocity equal to that of a glass of water which a conjuror will swing round without spilling a drop!

Taking this view of the matter, the wheel would be more efficient revolved in a contrary way; such, indeed, was what I thought was intended to be the case on a first glance at the engraving, and before noticing the directing-arrow or reading the description. A naval friend of mine, well acquainted with the subject, also, upon looking at another engraving of the wheel without any directing-arrow, and judging of the action merely from the drawing or plan, gave it as his opinion, that it was intended to turn in the direction which it appears would be backward.

Suppose Mr. Galloway's wheel to be effective in all the particulars which he claims, what is to be done in the backing of a vessel? From the shape and disposition of the paddles, they cannot be equally effective both ways of revolving; and if it has not the power of backing pretty quickly, it will be of little use in a river so crowded with craft as the Thames. In the course of navigating the pool, how often are the commands of the captain or pilot to the engineer—"back her!" "stop her!" uttered for the purpose of avoiding collision with large, or the running down of small vessels? From my own observation, I should say some twenty or thirty times in the course of a trip to Gravesend. Alas! for wherries, boats, and barges, when the adoption of Mr. Galloway's invention shall put it out of the engineer's power suddenly to stop and back the steamer by reversing the wheel's rotation!

Yours, &c.

SCRUTATOR MECHANICUS.

Dec. 28, 1835.

RAILWAY THEOREMS.

Sir,—I am sorry to see the pages of your useful Magazine occupied by erroneous theorems intended to elucidate well-understood subjects.

It is very generally known, that gravity generates equal velocities in equal times, or, in other words, that a heavy body left to the free action of gravity, has, at the end of one second, attained a velocity of 32 feet per second, at the end of 2 seconds 64 feet per second, and, to state it generally, at the end of $n+1$ seconds the velocity is 32 feet per second greater than it was at the end of n seconds.

It is also familiar to all persons who attend to these things, that if a body at rest be suffered to descend freely down an inclined plane, whose height is 16 feet, it will, when it arrives at the end of such plane, have acquired a velocity in the direction of the plane of 32 feet per second, let the length of the plane be what it may. And if it has a velocity of m feet per second when it begins to descend the inclined plane, it will have a velocity of $m + 32$ feet per second at the end of it. Hence the theorem, $v = V + g\,t \sin. i.$—See Gregory's "Mathematics for Practical Men," page 238, first edition.

In the above, friction and its effects are disregarded; and the fractions are rejected.

Yours, &c.

S. Y.

Dec. 28, 1835.

P.S.—Allow me to ask Iver M'Iver what "every writer on the subject" means s and h, to represent in the equation, he has given page 251.

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NOTES AND NOTICES.

The First Amendment of a Specification, under the late Patent Law Amendment Act was only enrolled a few days ago. We shall give the particulars in our next. There was a certain Special Attorney, it may be remembered, who asserted that as much had been done as far back as the 5th of October last (with the view of showing that *we* knew nothing of the matter), and who afterwards gave the Clerk of the Clerk of the Clerk of the Patents as his authority, which Clerk of the Clerk of the Clerk of the Patents never publicly denied that the falsehood had been traced back to its proper source. We leave both gentlemen to their own reflections.

Palladium has not until within the last few years been an object of attention from its great scarcity, the ore of platina being the only source from which this metal was derived, and in which Dr. Wottaston first discovered it in 1803 I noticed the existence of palladium in the Brazilian gold, in the year 1812, *Philosophical Magazine*, vol ix., but until my engaging with the Imperial Brazilian Mining Company, its extraction to any extent in a state of purity, and for use in the arts, had not been effected. Palladium exists in the gold of the Gongo Soco-district, partly in a native state, and partly in combination with the gold. It is separated by the nitric acid with the silver used for refining, and with which it was formerly collected. The properties of this metal render it intrinsically valuable in the arts, having most of the characters of platina,
which it also resembles in colour. I
roded by the action of the atmospher
fected by acids (except the nitric), un
dinary circumstances—is perfectly m
being only $11\frac{3}{4}$ specific gravity, has a
over platina in its introduction. It is
sively used in mathematical instrum
very fine gradations, also by dentists i
or platina, for lightning points, scale
weights, points of pencils, in lieu of
great variety of other purposes. Its
other metals are also highly interestin
silver, and prevents it from tarnishin
property it might be advantageously i
surgical instruments,—with copper an
the elasticity of the best steel. The ox
dium is used by enamellers for formin
brown colour.—*Mr. O. N. Johnson, Min*

◆

LIST OF SCOTCH PATENTS GRA
TWEEN THE 21st NOVEMBER
DECEMBER, 1835, INCLUSIVE.

John Reynolds, of Liverpool, ge
improvements in railways. Sealed at
December 7, 1835.

Samuel Faulkner, of Manchester, cot
for an improvement in the carding of
other fibrous substances, by a new ap
the machinery now in use for cardin
other fibrous substances. December 9.

Miles Berry, of No. 66, Chancery-la
in consequence of a communication n
by a foreigner residing abroad, for a
ment or improvements in the making o
ing of meters or apparatus for mea
water, and other fluids. December 9.

John Houldsworth, of Glasgow, cot
in consequence of a communication n
by a foreigner residing abroad, for
provements applicable to drawing an
frames used in the manufacture of cotto
fibrous substances. December 18.

☞ Patents taken out with econo
spatch; Specifications prepared or r
veats entered; and generally every
Patent Business promptly transacted.
of Machinery also executed by skilful
on the shortest notice.

Mr. R. Coles—Answered by post.

We are much obliged to Mr. Dixon
gestion, and shall do our best to open
book."

Communications received from Mr.
Mr. Crombie—Mr. March—Antiquus—
Chittenden—C. L. P.—T. C.—Mr. Mat
Waldron.

Erratum.—Page 252, first column, l
"*turned*" read "*tinned.*"

The Supplement to the last volume,
title, index, &c. and portrait of Charle
Esq., C. E., is just published, price 6d.
volume complete, in boards, price 9s. 6

LONDON: Published by J. CUNNIN
the Mechanics' Magazine Office, No.
rough-court, between 135 and 136, F
Agent for the American Edition, Mr
12, Red Lion-square. Sold by G. G
55, Rue Neuve, Saint Augustin, Par

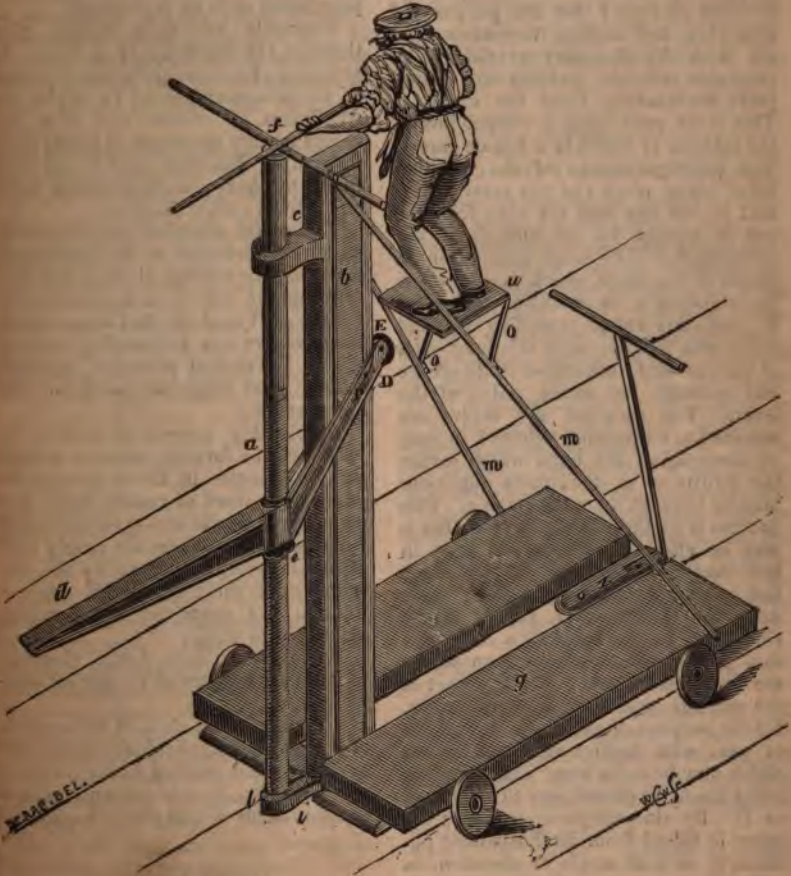
CUNNINGHAM and SALMON, P
Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 648. SATURDAY, JANUARY 9, 1836. Price 3*d*.

HUTCHISON'S PATENT PORTABLE LEVER.



HUTCHISON'S PATENT PORTABLE LEVER.

The portable lever represented by the prefixed drawing, consists of a square thread screw, *a*, three inches in diameter and nine feet in height, placed in a perpendicular position, at one extremity of a light and portable carriage *g*. Immediately in the rear, and within four inches of the screw, there is a cast-iron standard *b*, connected at its lower extremity with the bearing stand *i*, upon which the screw rests; within two feet of the top of this standard projects a collar or stay *c* for the purpose of steadying and causing the screw *a* to act with the necessary precision. A moveable cast-iron lever or arm *d* projects horizontally from the screw *a*. This lever rests upon a copper box *e*, the interior of which is a female screw. The principal action of the machine takes place when the two screws, viz. that in the box and the nine feet, are put in motion by the turning of the cross-head *f*. D is an oblique inclination of the lever, which presses upon the standard *b*, by means of the roller E; and this roller travelling up and down with freedom upon the back part of the standard, renders perfectly secure and accurate the entire action of the lever. The standard and screw are attached to a revolving axle at *i*, so that, by disengaging the bolts which secure the strutts *m m*, the whole apparatus may be lowered upon the stage *g*. This process is so exceedingly simple, that it may be effected with perfect ease in less than five minutes. N is a slight and removable platform, which rests upon the strutts *m m*, and is chiefly supported by the brackets *o o*. Upon this platform, the person who works the cross-head stands. The fore part of the carriage rests upon a swivel axle *z*, for the purpose of enabling the machine to pass with facility any obstructions which may be in its way. The travelling roller E may be placed near the standard at *P*. By this simple contrivance the lever is raised from its horizontal position to such an angle or elevation, as will suit the nature of the work it is required to perform.

It will be perceived, upon an accurate inspection of this machine, that it possesses several important advantages.

The facility with which it may be *conveyed, wherever its* services are required, is of itself a very strong recommendation.

To most of the machines which are employed in raising ponderous weights, a catch or lock is necessary to prevent the too rapid descent or falling of the article suspended by the rope or chain. But by the action of the portable lever, the article raised or lowered is always secure from the accident of slipping: it is therefore unnecessary for the man employed in turning the cross-head to adopt any precaution for the purpose of preventing such an occurrence.

Accidents are daily taking place through the breaking of a chain, the snapping of a rope, or the sudden illness of the person employed in turning the windlasses of cranes, and other machines usually employed in lifting heavy materials. But this lever is not liable to any of those disarrangements which result from such casualties.

This useful machine was constructed under the direction of Mr. Hutchison, expressly for raising, placing, and withdrawing the retorts in the London Gas Works at Vauxhall; and these various processes are now executed by means of it with the utmost precision, combined with a most important saving of time and materials.

A tolerably correct estimate of its value may be formed, when it is stated that it executes in fifteen minutes the entire day's work of twelve men. It is calculated that the saving to the London Company, where there are nearly 1,100 retorts in action, effected by this contrivance of their ingenious engineer, has, in the space of eight months, amounted to 400*l*.

There can be little doubt, therefore, of its being adopted at all similar establishments.

We understand that, in consequence of the peculiar applicability of this lever to lifting and placing heavy pieces of ordnance, &c., it is in contemplation to adopt it in his Majesty's dock-yards.

STREET-PAVEMENTS.

Sir,—In one of your late numbers, C. B. says, "Mr. Davy's remark that certain destruction awaits the knees of horses falling down upon the rugged surface of the new coach-pavement in Cow-lane, Fish-street-hill, &c., is *true* *to a certain extent ; but so long as the new pavement is kept in a good working state* (as rough as when *first* pitched I presume is meant), there is scarcely any fear of a fall, *except* in descending !"

Why, Mr. Editor, no one, whether riding or driving, dreads falling when going *up* hill.

Once more let me be heard through your columns in this matter.

My simple proposition, offered to the public in various ways more than eight years ago, was to pitch the streets with granite, rough on the edges or sides, three to four inches broad each way, of the same dimensions at the bottom as on the surface, and on no account to taper the stones more than where required.

By-the-bye, the wiseacre *improvements* of cutting by the chisel the large blocks, and now of setting the stones at an angle, prove that the city officials, who are always looking more to the money things will bring to their own pockets, than to the advantage of the public (for example, that infamous job Farringdon Market), were indebted to my suggestion for these modifications ; and again, let me din in their ears, "that it is the interstices between the paving-stones which ensures the safe foot-hold of the horse in his progress, whether slow or quick."

And farther, "that the size of the paving-stones laterally, is of as much consequence as their being shortened in the transverse or cross breadth (three to four inches each way is the full dimension) ; for every one knows that horses often slip sideways, as well as straightforward. These small stones with the openings between them, would render a paved road as safe, or safer, than a macadamised one, and less expensive, too, than the present heavy blocks ; for the pieces *of sufficient depth (fourteen or fifteen inches)* might be triangular, square, nearly circular, or of any shape, as chance might furnish them, if all rough, in some degree, on three sides, of an equal depth."

In short, this method I so long ago proposed, would approach, as near as can be, to the macadamised road, without its liability to wear out, and its occasional inequalities when new, and when worn down.

I cannot omit this opportunity of once more urging on the public the value of a railroad on the banks of the Thames, from Westminster to London Bridge, for passengers in steam carriages. The countless accidents occasioned by those insolent fellows, cab and omnibus drivers, together with the confusion and delay in passing to and fro from one end of this Babylon to the other, loudly call for prevention in some shape or other Allow me to refer to one of your former numbers for some of the details of my project, and to express a hope that some one, who has more time and money to spare than I have, will start the thing, and feel the pulse of the public thereon.

T. C.

Dec. 30, 1835.

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MR. HERAPATH'S RAILWAY THEOREMS.

Sir,—The concluding remark I made in my article (p. 219) was, "That Mr. Herapath had done himself great injustice by denying that his theorems for railway transit were not intended to be mathematically true." Let the reader contrast this remark with what Mr. Herapath states at the beginning of No. 2 of his series :—"Were I (says Mr. Herapath) to pursue the course most agreeable to myself, *and which might perhaps be expected of me*, I should begin with a mathematical investigation of the theory of railroads, &c." The only part of Mr. Herapath's investigations that can be called mathematical is given at the beginning of No. 3 of his series, viz. article 1, on the force of traction on an ascending or descending plane, the force of traction being $9\frac{1}{3}$lbs. per ton on a level. The expressions, "$1 \pm \frac{h}{22}$ very nearly," I admit to be true for all intents and purposes, that is, in the case of an equilibrio of the three forces, friction, steam, and gravity—then when the plane descends, and h is less than 22, the three forces are in the ratio of $1, 1-\frac{h}{22}$, and $\frac{h}{22}$; but when $h = 22$, then friction and gravity balance one another ; and when h is greater than 22, there cannot be an equilibrium between friction and gravity, unless we suppose that steam or some other force is employed in opposition to gravity. Also when the plane ascends, the three forces will be in a state of equilibrio, when they are in the ratio of 1, $1 + \frac{h}{22}$, and $\frac{h}{22}$. So far I agree with Mr. Herapath, but when he claps a crown upon the expressions, $1 \pm \frac{h}{22}$, and gives them the forms, $\dfrac{30}{1 \pm \frac{h}{22}}$ (30 miles per hour being the full speed on a horizontal plane), and informs us that they are expressions for the velocity of transit on a descending or an ascending plane, &c., I must tell Mr. Herapath that, although he could obtain a certificate of the truth of his theorems signed by every F. R. S. in the kingdom, I would still remain an unbeliever.

Mr. Herapath, in p. 182, vol. xxiii. attempts to give us what he calls a physical investigation of the truth of his theorems, deduced from principles given in his own theory of physics, (bless the mark!) but, strange to say, Mr. Editor, the great challenger of the Royal Society does not himself seem to have absolute confidence in his own handiwork, for he says (No. 618, p. 182), " Let it be distinctly understood, that *not being quite certain of the principle alluded to,* I do not offer it as a demonstrated solution; but I should be glad to see it brought to the test of experiment, &c." I am surprised that when Mr. Herapath was employed in making experiments on the Liverpool and Manchester Railway, he did not put this grand principle to the test of an experiment; or if the idea of its application has been an after-thought, he ought to have had it tested before he published it in the *Mechanics' Magazine*, when it might, *perhaps*, have been the means of propping up his own system of philosophy, and demonstrating that that grand principle which was first conceived by a *Playfair*, was doomed to be brought forth by a *Herapath*. But such sublime flights are too refined for a rough-shod Scotch Highlander; so I shall drop this part of the subject, and take a peep at Mr. Herapath's patch-work.

Some kind friend, no doubt, whispered in Mr. Herapath's ear, that infinite and negative velocities would be rather in*convenient for railway* transit; in consequence of which, or something else, he has thought proper to assume a fall of 6 feet per mile, or 1 foot in 880, as the greatest limit when full steam is applied. But in making this concession, Mr. Herapath is still satisfied (this is a new thought) of the perfect accuracy of his theorems, although it should exceed 6 feet per mile. In the last article which he has written on the subject (No. 643, p. 195) he says, " that his reasons for limiting the descending application to a fall of 6 feet per mile, are not from any *defect in the theorems,* but from considerations of safety." Well, in the case of a fall of only 6 feet per mile, and a starting velocity of 30 miles per hour, he calculates that the velocity attained at the end of a mile will be 41¼ miles per hour. And again (No. 9 of his series, p. 425) he tells us, that $2 - \frac{h}{11} = 2 - \frac{6}{11} = 1\frac{5}{11}$ minutes, the time in which 1 mile will be run. Now, a velocity of 1 mile in $1\frac{5}{11}$ minutes produces, at a uniform velocity, exactly 41¼ miles per hour. Hence it appears that Mr. Herapath, by some legerdemain trick, contrives, the instant the engine and train commence the descent, to convert the velocity of 30 miles per hour into a uniform velocity of 41¼ miles per hour! Instead of 41¼ miles, I calculated (No. 640) the velocity would only be 32⅘ miles per hour, and this I did upon the supposition that the steam could act as efficiently on the descending plane as on a level. In doing so I have rather overrated than underrated the power of steam, so that the velocities deduced from the theorem $\sqrt{V^2 + 2gh}$ (although far below those deduced from Mr. Herapath's theorem) are rather above than below what would take place in real practice. Farther, Mr. Herapath tells us that $t = 2m - \frac{mh}{11}$. Now, suppose $m = 1$ and $h = 22$, then $t = 2 - \frac{22}{11} = 2 - 2 = 0$, that is, the mile will be passed over in 0 time, or, in other words, the velocity will be infinite! Suppose, again, that h is greater than 22, the time of transit must be negative!!! Strange results these to be derived from sound mathematical premises! I shall just tell Mr. Herapath, that if ever he again attempts to give theorems on ascending and descending planes, he must contrive to introduce the symbol g, which, for our globe and for our latitude, is well known to be $32\frac{1}{6}$ feet. My next communication will, I suppose, be all up-hill work; and as this night happens to be Hogmanaye, I shall conclude, Mr. Editor, by wishing you, and all your numerous readers and contributors, a happy new year, and all the best compliments and wishes of the season, &c.

I am, Mr. Editor, yours, &c.
IVER M'IVER.

Dec. 31, 1835.

ON THE STATE OF THE ARTS OF DESIGN IN ENGLAND, AND ENGRAVING IN METALLIC RELIEF.

In the clear and satisfactory evidence of the Editor of the *Mechanics' Magazine* before a Select Committee of the House of Commons on Arts and Manufactures, he gives it as his opinion that we are not behind the French in design as applied to manufacture (most assuredly not)—and mentions the circumstance of patterns for the French market being supplied by English artists. The thing, I believe, is very common; and it brings to my mind the case of a very clever artist (now dead), Mr. Baxter, whose enamels on China were of the very first order. He waited on Mr. Hope to solicit his patronage; that gentleman said he could do nothing for him unless he adopted the French style, and he showed him some China he had just purchased. Mr. Baxter assured him that what he then saw was painted by himself, but that, in his own defence, he had been obliged to adopt the French mark.

Desirable as metallic relief engravings would be,* for the purpose of printing along with type, I imagine they never could be done to any considerable or useful extent, and can never extend much beyond outline; the attempt to produce any thing of a finished character would immediately involve an expense fatal to the whole affair.

An attempt has lately been made on steel, but it requires an after operation to sink those parts sufficiently deep which when printed are to be left pure white paper; that being the case, wood-engravings for printing with type will, I suspect, never be superseded. Lithography and soft ground both admit of an artist producing fac-similes of his designs—the former, though a sort of printing from the surface, cannot, that I am aware, be used with type; and the latter only with the rolling-press. There is another drawback to the production of original designs, *to be printed from*, and that is, the reversing of light and shade very often, and the action of figures always; for to make the latter (we will suppose swordsmen or reapers) *right*-handed on the impression, they must be *left*-handed in the design; this, though no difficulty to the engraver who copies, is a working in shackles to the artist who designs.

In answer to the question, Has justice been done to them (the artists) in allowing them a free inspection of works of art?—the answer is, I do not think it has; it certainly has not. Take the British Museum, for instance, which being supported by the public money, the public should have the full benefit of; it seems only opened for the convenience of those who have places there, not for the benefit of those who visit it. At all holiday times it is shut; of a Sunday it is shut; of evenings the same. I here confine my remarks to the Elgin and other marbles, those are the rooms more immediately addressed to the artist.

What I should propose is, that these rooms, in particular, should be open to the public after the morning service on Sundays, and at all holiday times, when many could avail themselves of these beautiful works of art, who otherwise could not; as it is, they are at the times mentioned closed, and silent as the grave. Indeed, the Elgin-room, beautiful as it is, is the most ill-contrived for the purpose of study, and is now almost deserted. There is so much light in every direction, that the figures, &c. are nearly without shade; this would not be the case if properly lighted up of an evening in the manner of the Royal Academy.

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* Landseer, in his fourth Lecture on Engraving (p. 201), delivered at the Royal Institution, observes on this interesting point:—"I am under the necessity of postponing, in part, what I may have to state on the subject of wood-engraving, in consequence of certain suspicions which I could not help entertaining, and which I have not yet been able to remove, that at least some of the productions of the old masters, which are generally thought to be impressions from wood, are really printed from some other material, and perhaps from the substance (whatever it may have been) that was originally used for letter-types. It appears to me, from the freedom and frequency of the dark crossings which distinguish these works from modern wood-engravings, and from this mode of working being obviously the *easiest* mode of producing the effects which their authors had in view, that they are either etchings (the lights being corroded away), or, which is yet more likely, that a prototype or matrix was *cut in intaglio*, probably with *the graver, in which the tablets from whence the prints are taken were cast in the manner of letter-types.*"

I merely throw out these remarks, subject, of course, to laws and regulations, as hints for making these, as well as other works of a similar nature, more available to every class of artists in this country.

R. R.

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MR. ELIJAH GALLOWAY'S PADDLE-WHEEL.

Sir,—A copy of your publication of the 26th ult. having been sent to me, I perceive therein a description of Mr. Elijah Galloway's new paddle-wheels for steam-boats. As that gentleman is, at present, in the north of England (superintending the application of his invention to several steam-vessels of the largest class), I feel it necessary, on his behalf, to notice your comments.

To your remarks, on the absence of certificates in Mr. Galloway's circular, it is only necessary to reply, that it was only intended for *private* circulation, and the facts merely were stated, and references given, by which corroboration was easy; as the circular was only addressed to persons interested in such an invention, the natural course for them to pursue was to have made farther inquiry. I am able to state, that Mr. Galloway is in possession of such testimonials, from impartial witnesses, as would convince any one of the efficacy of his new paddle-wheels. If you had taken the trouble to have inquired of any of the persons named in the circular (and which you ought to have done before questioning the accuracy of the circumstances therein stated), you would have found this to be the case; and that the fact of the superior performance of these wheels did not rest, as you assume, on Mr. Galloway's solitary testimony. I attended professionally, together with several others, on board the Monarch steam tow-boat, both before and after the application of the new wheels, and can positively affirm, that, without any other alteration, either in the vessel or machinery, her speed was improved nearly a mile and a half per hour. The swell and vibrating action were also removed. I did not witness the experiment with the Rose steam-boat, but I know that the proprietors of that vessel have been induced, by the result in this instance, to order (and pay a patent premium for) other wheels; a circumstance, I presume, which sets the question of their superiority wholly at rest.

I cannot avoid regretting the unfair spirit which seems to have actuated your remarks upon Mr. Galloway's inventions, and on his connexion with Mr. Morgan. You have very incorrectly stated, that Mr. Galloway sold his invention to that gentleman, *for a valuable consideration*. I am able to state, that Mr. Galloway devoted years of his time to bring that invention into successful operation, and was finally sued by the creditors of Mr. Morgan for the money paid him for merely personal expenditure; and that, so far from *receiving* a consideration, he *paid a large sum* at the final assignment of his right, to avoid the expenses and uncertainty of a law-suit. Notwithstanding these circumstances, Mr. Galloway came forward voluntarily as a witness in the cause, "Morgan against Seaward," to prevent the injury which perjury would otherwise have produced on the plaintiff's case. You are aware of the effect of that evidence, having been yourself a witness in the case. These are private affairs, however, with which the public have little to do; but as you have introduced the subject, it is but fair that the matter should be placed in its true light.

Mr. Galloway has, since the period of his connexion with Mr. Morgan, applied himself unremittingly, and through years of labour and privation, to this highly interesting department of science; and, I am proud to give my humble testimony, that he has, at last, realised a decided and valuable improvement, and feel assured, that he will speedily obtain a competent reward for his indefatigable and useful efforts.

I am able to add, that Mr. Galloway has entered into contracts for the whole of the vessels of the City of Dublin Steam-boat Company, and other proprietors in the North; the vessels of which amount to several thousand horses' power, and some of them are of the same class with the Monarch steam-ship.

I am, Sir,
Your obedient servant,
THOMAS GILL, Advising-Engineer.

Patent-Agency Office, 125, Strand,
London, Jan. 5, 1836.

Alas! for Mr. Galloway, if he can

make no better defence of himself than his agent, Mr. Gill, has made for him. Mr. Gill says, that Mr. Galloway's circular was "only intended for *private* circulation," meaning thereby, we presume, that it was very wrong in us to make the contents of it *public*. We know well that it was intended for *private* (*very* private) circulation—so private, that it should, if possible, reach the hands of no one who could detect the gross misrepresentations which it contained; and therefore it was, that we felt it to be our duty to give it all the publicity in our power, that the dishonest object sought by such privacy might be defeated. We charged Mr. Galloway with practising a deliberate imposture, in stating that his new paddle-wheels had been fitted to "THE Monarch steam-vessel," inasmuch as the vessel known to all who are acquainted with British steam-navigation as THE Monarch, is one of the largest and best appointed steam-vessels afloat; while *the* Monarch to which Mr. Galloway's wheels have been actually applied is an old tug-boat, of some 20 or 30 tons burthen only, made use of for experiment merely—never heard of before by one nautical person in ten thousand—and which may, for any thing we know, have been thus royally christened for the nonce, that is to say, for the purpose of making persons not on the spot believe it was the real Monarch. Does Mr. Gill deny these facts? Does he dispute that Mr. Galloway's words were designed and calculated to convey the false impression we complain of? Nothing of the kind. He admits, on the contrary, that it was *not* "THE Monarch *steam-vessel*" which was really referred to, but "*the* Monarch steam *tow boat*;" and in admitting that, he admits "the head and front" of his client's offending. But, says Mr. Gill, "if you had taken the trouble to have inquired of any of the persons named in the circular (and which you ought to have done before questioning the accuracy of the circumstances therein stated), you would have found that the fact of the superior performances of these wheels did not rest, as you assume, on Mr. Galloway's solitary testimony." We think we know what we "ought" to do *in such cases as the present* quite as well as Mr. Gill can tell us; and feel assured that we did all that any reasonable person could expect of us. Foremost among "the persons named in the circular"—or referred to rather, for there was nobody named—were, of course, the captain, owners, and agents of "THE Monarch;" and to one of these parties we did apply, who told us that the name of their vessel had been most unwarrantably and shamefully made use of. Was not this enough? Who, after being troubled with one false reference from a party, ever thinks of attending to a second? Mr. Galloway did not deserve, at our hands as honest journalists, that we should make a single further inquiry on the subject. Nor, though we had gone through all the "testimonies" he may be in possession of, should we, in all likelihood, have approached one step nearer the truth. The evidence which Mr. Gill has now volunteered in his client's behalf is, we dare say, as strong as any evidence that Mr. Galloway is able to produce. And what is that evidence? All "swell" and "vibrating action" removed, and an increase in speed of "nearly a mile and a half per hour"!!! We laugh to scorn such pretensions. Mr. Gill, as a gentleman not without some distinction in the scientific world, should be ashamed of lending them the sanction of his authority. The "swell" and "vibrating action" are not all caused by the wheels, and could not, therefore, be all removed by any improvement in them; nor, though Mr. Galloway's wheel were ten times better than it is (for, after all, it has some good points), could it possibly produce in river-navigation so considerable an increase of speed as Mr. Gill attests it to have realised. If it be on the faith of such representations as these that Mr. Galloway has obtained so many orders for his wheels from "proprietors in the *North*," there must be wonderfully less wisdom in the *North* than the world has been accustomed to ascribe to it. But, after what we have seen, we must, with all due respect for Mr. Gill, take leave to doubt the perfect accuracy of his information on this head. With respect to Mr. Galloway and his connexion with Mr. Morgan, it may suffice to say, that we know nothing of its history; and that in assuming there was a "valuable consideration" given by Morgan, we only took that for granted, which the law declares to be an essential ingredient of a good assignment of property. Mr. Gill cites, as a proof of Mr. Galloway's honourable treatment of Mr. Morgan, the evidence which he voluntarily gave in the cause, Morgan *v.* Seaward, "to prevent the injury which perjury would otherwise have produced on the plaintiff's case;" but he forgets one thing which, it is only fair to all parties (the witness so harshly alluded to more particularly), should not be left out of sight, namely, that it is still a moot point on which side the perjury lay.—Ed. M. M.

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FIRST DISCLAIMER UNDER THE LATE PATENT LAW AMENDMENT ACT.

The first patent which has been amended under the late Act is that of Benjamin Rotch, Esq., for "improved guards or protectors for horses' legs and feet under certain circumstances," dated 20th of March, 1830. So important and peculiar was this invention, that double the usual time, that is, twelve months, were granted to the patentee to make up his mind as to the specification. We took some notice of it at the time of its appearance (see Mech. Mag. vol. xv. p. 246), and as the reader will see by reference to our remarks, did not think quite so highly of it as its inventor, or rather patentee. Mr. Rotch now states in his disclaimer (inrolled Dec. 22, 1835), that having since the inrolment of his specification discovered that surgeons and others have used bandages for parts of the *human* frame made of caoutchouc, he is doubtful whether he can claim the applying of the same to *horses'* feet and legs as his invention! He then disclaims the words "and feet" in his title, and in his claim; thus limiting the application of his India-rubber protectors to the legs and knees; though his premising *doubt* takes even this limited application away from him, if such doubt be well-founded.

The principal part of the invention consisted in stretching a bottle of India-rubber, and pulling it over the hoof of the horse up to the postern-joint. This he disclaims.

This India-rubber boot was to be protected by an iron shoe, consisting of a plate, the shape of the sole of the hoof, with arms projecting at intervals round it, which were to be folded up and bent against the front and sides, thus grasping the hoof. Very broad-headed rivets were also to be used in fastening the caoutchouc to the iron, which iron it was provided, might be protected by a slight shoe of steel of the ordinary shape. All these things, too, are disclaimed.

Ordinary bandages covering wounds on horses' legs were to be fastened at each end by a ring of India-rubber, clasping and holding by its elasticity the dressing in its proper place. This, also, is disclaimed.

Another part of Mr. Rotch's invention was a cylinder of India-rubber, which was to encompass a wound on the leg or knee of a horse, and by its elasticity keep the dressing in its place. This, although not formally disclaimed, his first *doubt*, if well-founded, certainly puts an end to.

Some other trivial disclaimers are made in the mode of making the India-rubber into bandages, &c.; and some verbal amendments are also made for the purpose of rendering the construction of the sentences, consistent one with another.

Mr. Rotch has, in fact, disclaimed his whole specification; he might well have saved himself the trouble, as, in all probability, its validity would never have been called in question.

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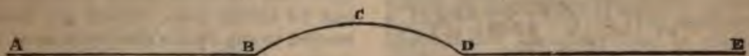
SOME SUGGESTIONS RESPECTING A NEW PRINCIPLE IN THE CONSTRUCTION OF RAILWAYS FOR LOCOMOTIVE ENGINES.—BY THE AUTHOR OF "THE GREAT WESTERN RAILWAY COMPARED WITH OTHERS," "THE RAILWAY TABLE," &c.

The nearest distance between two points being a straight line, railways are generally made as nearly straight as circumstances will admit. Deviations from a direct line, when admitted, are made to curve as gently as possible, to avoid any material increase in the friction against the rails. It has been usual to lay out the curve portions of railways as portions of circles, having certain given diameters, but as large as the nature of the country will allow, or other obstacles that may present themselves permit. In the descriptions given by engineers of projected railways, we always—unless the railway is to be perfectly straight — find them name the curvelinear deviations as portions of circles; and some have laid it down as a rule, that, if the diameter of the circle, of which the curve portion of the railway is a part, exceeds three miles, the friction on the rails will not be materially greater than that on a straight line. I have not heard of any other curve having been introduced; but beg to suggest there is a great probability that there are many other curves that might be as easily laid down as the circle, which would offer less resistance from the friction of the wheels against the rails. Why should there not exist in nature a curve of least resistance, as well as a curve of quickest descent? I know of no reason to the contrary; but, to avoid controversy, I will, at present, only suggest that there is a *great probability* in favour of a railway of *least resistance*. That your readers may satisfy themselves, I will propose to them, with your permission, the two following propositions, which, when solved, will determine whether—a thing which I have for some time doubted—the perfectly straight line, whether level or inclined, is the most eligible for railways for locomotive engines:—



Prop. 1.—Let A B C D E represent a horizontal railway; which, to avoid a hill, begins to diverge from a straight line at B; and from B to D a portion of a circle is described, whose diameter is *d*. What resistance from friction would an engine with four wheels have to encounter, when moving on such portion of railway, *more* than on the straight line A B or D E, supposing the velocity to be *v* miles per hour?

The solution of this proposition will determine the advantage of a perfectly straight line over a circular one; but a circular deviation brings into operation other elements of retardation than simply the friction on the rails. Besides the friction on the curve to be overcome, there will be a portion of the engine, and in practice a portion of the carriages attached to it, which is not supported on the railway to be propelled. The motion of the engine on such railway will somewhat partake of the nature of the conical pendulum, and its transit along the curve will resemble the oscillation or partial oscillation of such pendulum. The force or power necessary to propel the unsupported weight will vary with the diameter of the circle, or with the length of the *ordinate* of the curve, along which the engine passes. If the circle be small, the additional friction, &c. will be considerable; *if large, proportionally less.*

Prop. 2.—On most railways it is requisite to deviate from a straight line, on account of obstructions: in such cases the line of deviation becomes curvilinear. What is the nature of the curve that will offer the least resistance to the wheels of carriages propelled by means of an engine?—and what the quantity of friction under the circumstances of Prop. 1?

The result obtained from an investigation of this proposition, compared with that derived from the first, will exhibit the advantage to be gained from the introduction of the railway of least resistance, and will determine what I consider to be a very important matter respecting the construction of railways, because of the unlimited scope that is left for the free introduction of improvements into every other department of railroad engineering, without at all interfering with the line of direction, and because of its easy application to the pneumatic system with fixed engines, as well as to the common with locomotive engines.

At first it may appear to be ridiculous and unreasonable to suppose that there can be any other line laid out than a straight one, that will offer less resistance than such direct line; but, on consideration, the unreasonableness will disappear, and those persons who will take the trouble to solve the propositions above, will, I doubt not, have the satisfaction to announce that a curvilinear line of railway may be laid out that will offer less resistance to the wheels of engines and of carriages than a perfectly straight one.

Independent of a direct investigation of the last proposition, the result to be derived from it may be anticipated. The contemplation of the operations of nature lead us to the conclusion that the curve of least resistance for railways is the cycloid, or the epycycloid. Nature always performs her operations with the least power, and in the shortest time. The contour of the waves of the ocean have been determined to be cycloidal arcs, and the undulations of the atmosphere are by many believed to be the same. Such, and many other considerations gave birth to the idea of a *railway of least resistance*. But it ought to be understood that in all probability it would be impracticable to construct a railway of one entire cycloidal arc; and, therefore, to avoid difficulty, let there be projected a series of cycloids or epycycloids, connected with one another in such manner as to form a *serpentine, lateral, undulating line*, composed of arcs alternately concave and convex to a straight line, joining the two extremities of the railway. Such railway may appropriately be denominated the *lateral undulating railway*. This novel subject well deserves the consideration of the engineer and the railway director. The cycloidal direction requires only to be tried to ensure its adoption. However, should any be doubtful, let him first introduce the curve, partially for the sake of experiment, on some railway now being constructed, where it is absolutely requisite to deviate from a straight line. Instead of the circular deviation, let the cycloidal or epycycloidal be substituted, and experiments be made, before confidence is placed in the superiority of *lateral undulating railways*, or even in the substitution of the cycloid for the circle on portions of railways, where deviations are absolutely necessary.

JOHN BRAVENDER.

Cirencester, Jan. 1, 1836.

THE EUDIO-ENGINE.

Mr. Editor,—I have invented an engine which is denominated an eudio-engine, and supposed to be equal to a 1-horse steam-engine, for the purpose of applying, as a motive-power, the expansion that takes place previously to the union of hydrogen and oxygen gases, to propel carriages or vessels, or for any other useful purpose. The cylinders are made of gun-metal, and are each 18 inches long, with a bore of 3 inches; an electrifying-machine, to explode the gases, is attached to the engine. The electric fluid is, by a novel contrivance, elicited in a damp atmosphere, and also in a shower of rain.

The action is, like steam, sudden, and very powerful. The engine does not require water, a boiler, or furnace; and the only substitute is a fire-grate, not more than 10 inches long, 8 inches broad, and 10 inches deep. Coals are merely wanted to supply the consumption of the grate, and to generate the hydrogen gas; for this latter purpose the smallest coal-dust may be employed. A gasometer, not larger than the area of a cube foot, is prefixed to the engine, together with a retort.

No more hydrogen gas is generated than what is required for each stroke of the piston, and, consequently, only evolved as it is consumed. The liability of the cylinders bursting is not greater than in a high-pressure steam-engine; and should that happen, the danger would be much diminished, there not being any water used.

Messrs. Brown and Wright have taken advantage of the partial vacuum that is formed after the union of the hydrogen and oxygen gases; but to produce that, a great quantity of hydrogen gas is required, independently of the gas consumed by four lights burning the whole of the time the engine is at work.

I beg to announce to your numerou readers, that an exhibition (gratis) o its mechanical arrangement takes plac daily, between 10 and 2 o'clock in th day, at 55, George-street, Euston-squar St. Pancras, where any interrogatory pr posed by any visitor is answered respec ing it, and every requisite explanation the mechanism given by,

Mr. Editor,
Yours most obediently,

AUGUSTUS BRACKENBUR

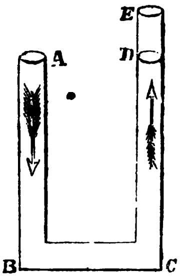
London, Jan. 4, 1836.

PARLIAMENTARY EVIDENCE ON ACCIDENTS IN MINES.

(Continued from p. 270.)

Examination of Mr. Nicholas Wood, continued:

[*Witness delivered in the following calculation of the power of the furnace in Coal Mines to produce ventilation.*]



Let A B represent the shaft or pit which the air is to descend, or what is called the downcast shaft; C D, the shaft up which the air is to ascend, or the up-cast shaft; and F, a furnace placed near the bottom of the shaft C D.

The effect of the furnace is to heat the air passing over it, which, ascending the shaft C D, forms a column of air of much less density than the air in the shaft A B. It is the difference between the densities of the two columns of air, A B and C D, that produces a continual current of air down the former, and up the latter shaft; and this current of air is increased or diminished as the difference between the density of the one and the other is increased or diminished.

The length of the column, or depths of the shafts, has likewise a considerable effect in producing a greater or less velocity of the current. Let D E = the increase of height of the column of air C D, by the rarefaction of the furnace; then the velocity produced by such rarefaction will be equal to that which a heavy body would acquire in falling through the space E D. Now, the increase of the height D E will be proportional to the length of the column of heated air, C D; hence deep shafts afford more powerful means of ventilation than shafts of less depth. The length of column D E is, as before stated, in direct proportion to the depth of the shaft, but the velocities acquired by falling bodies are as the square roots of the height; the ratio of effect of deep shafts in producing ventilation is, therefore, as the square roots of their depths.

Having, therefore, the depth of the shaft, and the degree of temperature of the two shafts, we can calculate the effect of such rarefaction in producing a current of air in the mine.

Let B = the height of the column of air in the shaft A B.
t = the temperature of air in ditto.
t' = - - ditto - - in shaft C D.

Then $B\frac{450+t'^{*}}{450+t}$ = C E, height of column of air in the shaft C D, whence C E—C D = D E.

The velocity which a heavy body acquires in falling, one foot in eight feet per second, nearly.

Therefore, $8\sqrt{DE}$ = the velocity of current produced by the rarefaction of the temperature t'.

Or, let h = the height of the column or depth of the two shafts, supposing them both of equal depths.

Then the velocity v produced by the excess of temperature $t'-t$ in the two shafts will be,

$$v = 8\sqrt{\frac{h(t'-t)}{450+t}}$$

Taking a furnace, or furnaces, placed at the bottom of a shaft, to keep up an increased temperature of 30°.

Say, $t = 60°$.
$t' = 90$.
And $h = 300$ feet.

We have $v = \frac{\sqrt{h(t'-t)}}{450+t} = 33{\cdot}36$ feet per second.

The velocity which would be produced by that degree of temperature being continually kept up, and supposing the air free from impurities of greater density than the heated air. The smoke of the furnace will diminish this velocity by its greater density, supposed about one-twentieth part; leaving a *power* of furnace, under those circumstances, capable of producing a current of air down and up the shafts, A B and C D, equal to about 30 feet in a second.

When it is attempted to divert the current from its direct passage up the shaft into the mine, for the purposes of ventilation, every change of direction, and the almost innumerable obstructions to which it is necessarily subjected in its passage through all the avenues of the workings, waste, and furnace, reduces this velocity very considerably; and, accordingly, in practice, we find that in extensive mines a current of air of little more than three feet per second can be calculated upon.

My object in making this calculation is to show the power of the furnace, by which some comparison can be made between it and the power of an air-pump.

Did you ever compare the difference in ventilation where the furnace was placed at the top and at the bottom of the pit?—I have.

Did that confirm the result of your calculation?—Yes, I think it did; all my experience goes to prove that the deeper the shaft, and the longer the column, the greater power of ventilation is acquired; and I have known instances of furnaces being placed at the top of the shaft, and the column above the surface having to be increased in height to produce a better ventilation.

Do you make any allowance for the friction in your calculation?—No; I calculate the power of the furnace first, and then make allowance for all the various resistances.

Do you think that a common engine stack acts in the same degree, in the ratio, to the square root of the height?—Yes, I think it does, except it is contracted.

Supposing it is of the same size?—Yes, I think it does in that case.

Is that opinion formed from experiment?—It is formed from observation and experiment, and I would refer to Mr. Tredgold on Steam-Engines, who uses a similar formula for calculating the effect of steam-engine chimneys.

Have you ascertained the correctness of that formula from actual experiment as to the velocity of the air passing through mines of different depths of shaft?—It is very difficult to make such an experiment, because in *that case you would lay the whole of the workings of the pit stagnant*; but I made an experiment upon the pressure on the two sides of a partition in the shaft, and that pressure, as indicated by a barometer, corroborated the calculations I have now shown.

You state that three feet a second is the greatest velocity with which the air circulates through the mine?—I would not say the greatest velocity. I made an experiment a very short time ago in the Springwell Colliery, where there are two separate currents from the down-cast shaft, one of which travelled more quickly than three feet in a second through a sectional area of forty-eight square feet, but three feet is what we call a very good current.

It has been suggested, that if there is a current of air passing at the rate of 300 feet a minute, it would drive the flame through the meshes of the safety-lamp; are you aware that there are any currents of air passing at that velocity through the mines?—Not where the mine is in an inflammable state.

Do you think that the barometrical pressure upon the sides of the partition is a sufficient test of the velocity; may it not show the difference of density without showing the velocity of the current?—It was an experiment on the difference of pressure or density.

Does not the difference of pressure show rather a difference of density than a difference of velocity?—It does; but as a confirmation of this experiment, a calculation according to the difference of density in the two sides of the partition, ought to produce the current which the degree of heat calculated by the formula did.

Would not that heat produce a difference of expansion of air rather than a velocity of that expanded air?—I ascertained the heat of the air in the air-shaft; that heat ought to produce a certain degree of rarefaction, which degree of rarefaction produced unequal weights of air in the two shafts. The barometer indicated, so far as I could observe, the exact difference which the densities ought to have been.

Would not that show the buoyancy of the expanded air rather than the velocity?—It certainly did.

Then the difference of the barometer would not be a confirmation of your experiment?—Only so far as showing the difference of density, which was such as the degree of temperature should have produced.

Did you ever know a system of fanners,[*] upon the principle of the common winnowing system, only upon a larger scale, used for ventilating the mine?—No, I have not.

Will you have the goodness to state the result of your experience or practice with the air-pump in ventilating mines?—I do not know from my own experience the velocity of the current that has been produced by an air-pump. If I made any statement, it would be a matter of opinion.

Have you ever seen a large air-pump, upon this scale, at work for this purpose?—I have.

Where?—At Heaton colliery, and at Hebburn collieries.

Have you taken the size of the cylinders or the powers?—No, I have not.

Are you acquainted with the powers, or with the reputed powers of these machines?—I have only heard by report of the current of air produced by those machines; but I believe a witness, who will be examined by this Committee, knows from his own experience the quantity of current that they produce.

You consider ventilation as a point of the first importance in the protection of the miner?—Of the very greatest importance; to produce a good current is of the very greatest importance.

Of greater importance than any improvement upon lamps could be?—I should not, perhaps, go so far as that; it is of infinite importance for the perfect ventilation of the mine to have a good current in it; the ventilation is, in fact, a current carrying off the impurities and bad air.

Do you think the area of the up-cast pit, as compared with the down-cast pit, has any thing to do with the ventilation?—I think the area of the up-cast pit ought to be larger than that of the down-cast pit.

Have you ever tried the experiment of an enlargement of the exterior opening of the up-cast pit, what effect that would produce upon the current?—No, I have not.

You are aware, that in the case of the discharge of water it has a considerable effect?—It has; but I should not think in air that it would have much effect.

Do not you think that the same principle would govern both?—I am afraid not; the principle on which the water acts in that case is by its increased weight; now, the pressure created by any enlargement of the shaft in that case would be very insignificant indeed.

Do you think the pressure of the air upon the down-cast pit, as compared with the pressure on the up-cast pit, where the current is made by the rarefaction of the air, has any thing to do with the producing of the current?—I should think it has not, except in a mechanical way, by resisting the velocity of the current.

Supposing it were possible to remove the pressure of the current from the up-cast pit, and the pressure still continued upon the down-cast pit, do you consider that that would make a considerable current upon the mine?—Certainly it would.

Equal or greater than the present current produced by the draught of the furnace?—To have any effect upon that, it should be a vacuum that could be kept up at a greater velocity than the velocity that the air is issuing out of the furnace or up-cast shaft; if my calculations are correct, an air-pump with a piston moving thirty feet in a second, would be required of the area of the shaft, to keep up the same velocity of current as a powerful furnace.

Do you think that the effect of the rarefaction of the air passing through the furnace is equal to fourteen or fifteen pounds an inch?—No; the difference of density is very little.

But you are aware that the pressure of atmosphere upon the down-cast pit is equal to fourteen pounds an inch?—Yes.

If the pressure were removed from the up-cast pit, would not the pressure of the atmosphere in the down-cast pit, being equal to fourteen pounds an inch, cause a current through the mine?—It would have a great effect in producing a stronger current, but then I feel that there is great difficulty, in fact an insuperable difficulty, in carrying that into effect, because you must have a vacuum moving at the rate of velocity at which the air issues from the shaft, to produce any effect at all, and to produce an effect equal to the furnace, must move considerably quicker; and I believe the velocity at which pistons generally move is not more than 200 feet in a minute.

Which you have described as about three feet in the second?—Yes; but the power of a furnace is considerably greater; nearly ten times as much as that; but then there is the compression of the air, which reduces the velocity to three feet in a second. The air has to go several miles round about the workings. It is well known, that through small tubes you cannot force air to any great distance: I believe there was an experiment made at the Carron Iron-works, by endeavouring to force air through pipes between one of the furnaces and the other, and the effect was, that although a very considerable air-pump was employed, the resistance of the air was such as to counteract that, and very little current came out of the pipes.

Do you think that the reverse of the experiment would be good, that if you abstract air from the other end of the pipe there would be any difficulty in the air supplying its place through the whole current?—I should think that it would act according to the same laws as by pressure.

Supposing a pump were to proceed till it caused a vacuum at one end, do you not think that the air would follow from other parts of the column, so as to produce an equilibrium of pressure through the whole pipes?—I think it would follow, but I think that the spring of the air would have so great an effect upon it that it would flow with a small velocity; the velocity would indeed be in proportion to the size of the pipes, and to the obstacles that it met with.

Can you contemplate a case of this kind, a pipe of six feet in diameter and five miles in length, and at one end a perfect vacuum?—I think, in that case, the air would move with considerable velocity, but that that velocity would be considerably diminished by the spring of the air.

Do you think that the friction of the air through a given tube is increased as the density increases or diminishes, according to its density?—I should think in some proportion, but I would not state in what proportion.

If that were the case, would not the consequence be, that at the vacuum there would be much less density and much less friction, so as to enable it to supply the air which had been extracted?—I think the friction would be less, certainly, but I could not state any specific amount of velocity that it would be.

The velocity of the steam-engine piston, being about 200 feet a minute?—I should say that a tube six feet area, five miles long, with a piston travelling at 200 feet a minute, would not produce a current any thing like what a furnace does.

At the end farthest from the entrance of the air?—Yes; I think that it would have to be a much greater area indeed; and I am borne out in that by the effect of air travelling in the mines as checking the velocity at the up-cast shaft.

In the case which you have tried, was it tried with a furnace or without a furnace?—With a furnace.

Do not you think that the effect is very much diminished by that circumstance; would not the effect be, that an engine would be working the rarefied air?—The experiment that I mentioned was a barometrical observation.

You spoke of a pump once working; in that case was a furnace used?—There was not.

Will you give a verbal description of the drawing?—It shows a section of a shaft, with a bratice down it; the position, with respect to that shaft, in which the furnace is placed; and it shows also another drift coming into the shaft at a higher level.

That is, from another seam of coal, or from the same seam at a different level?—The upper drift is generally in stone. I wish to speak of this as one of the principles of using furnaces in mines, which principle is, that the furnace is placed near the bottom of the shaft; that another drift, in mines producing inflammable gas, is brought in at a higher level up the shaft, the use of which two drifts are, that all the air from the whole mine, or air that is not contaminated with inflammable gas, is made to pass over the furnace; and that the air which is contaminated with gas, and which proceeds from the pillars working, or wherever it is liable to become so charged as to be inflammable, is made to pass along the upper drift into the shaft, without coming in contact with the furnace.

Do you know of any case in which the carburetted hydrogen is taken off by such a drift, in sufficient quantities to ignite at the top of the shaft?—I know instances where the air, coming along this drift, would ignite at its entrance into the shaft, but when it comes to be mixed with the other air in the shaft, it becomes diluted; and I cannot say, at present, that I know of any instance where it is inflammable at the top of the pit after being so diluted.

Where the gas is carried from the mine to the top of the pit in pipes, there it is consumed?—I believe at one colliery it is; and in another instance, under my charge, we pipe the gas from the seam to the top of the shaft.

The process of ventilation having been accomplished by those various means, what objection do you conceive exists to the use of candles in such a mine?—In working the whole mine it is almost in every case absolutely necessary that candles should be used; in many cases a great majority of the mines produce very little gas, and where the gas produced is not more than can be carried off the workings with safety by the means described, I think candles may be used with perfect safety. Where the discharge is of course so great, either in working the pillars or the whole mine, as that it cannot be carried off without becoming inflammable, lamps should be used.

But you are aware of the existence of many mines in which the proportion of carburetted hydrogen is so small that there is nothing to fear as regards an explosive atmosphere?—In the great majority of collieries upon the Tyne, I think the ventilation may be carried on without any risk of such accidents occurring.

Then the introduction of lamps in preference to candles is a question to be decided by the experience of the viewer?—I think so.

What lamp is in use in the collieries under your view?—I have used different kinds of lamps.

What do you consider the best?—I have brought different lamps with me, for the purpose of explaining that to the Committee.

Will you have the goodness to produce the lamps which you have heretofore used, pointing out those which you think ought to have a preference, under the circumstances which have come under your observation?—These are the several lamps, and this is a steel-mill, by which light was originally obtained, prior to the use of the lamps in inflammable mines.

[*The Witness produced several lamps and a steel-mill.*]

Have you marked the lamps in any way?—I have not.

Will you have the goodness to put a mark upon each of them, numerically, so that the Committee may understand of which lamp you are speaking in the course of your examination?—I have now numbered them; there are five lamps.

Will you give your description of No. 1, and of the following numbers?—No. 1 is the common Davy-lamp; No. 2 is the common Davy-lamp, with different seams; No. 3 is Dr. Clanny's lamp; No. 4 is the common lamp, with glass; and No. 5 is an improved construction of the lamp with glass.*

What do you consider to be the nature of the improvement as regards the seams in No. 2?—The common form is, in my opinion, better than the lamp with different seams.

You consider that the alteration in the seams is not an improvement?—No, not in safety.

Do you consider that they are more or less liable to break?—I think they are not so strong.

Is the mesh of the wire the same in both the lamps?—It is.

What was the assumed benefit of No. 2?—It was made by a different person; it was an idea of his that it was more neat, and I believe some may be opinion that it is stronger; but I think the old form is quite as strong as the other. There seemed to be an objection to the doubling of the wire in the old form, and No. 2 obviates it; but I should not think that the alteration is any great improvement, though I do not say that it is worse in practice than the other.

From your practical experience, you do not perceive any benefit to be derived from the alteration in the mode of seaming?—I think no benefit.

Have you ever known circumstances of the lamps breaking at the seam prior to their being worn out or injured in fair wear and tear in other parts of the seam?—Not within my own knowledge; but I have not the means of knowing that. The lamps are in the care of a person, and they go to him; I have not heard that such a circumstance is of frequent or dangerous occurrence.

As viewer of the mine, is it not his duty to report to you any thing relative to the safety, or otherwise, of the lamp?—If any serious defect was discovered in the construction of the lamp, I would say that it was his duty to report to me, or any wilful neglect, injuring lamps; but when the lamps are worn out it is not necessary that he should do so; his duty is to attend to them, and keep them in good order; no lamp proceeds from him without his first examining whether it is perfectly right in all the parts of it, and he is accountable for the perfection of the lamps before they are used. The lamps are never sent into the mines unless they are perfectly complete, and inspected by him.

It is understood that the viewer directs the kind of lamp which shall be in use in the mine, or certain parts of the mine, and the man that takes care of the lamp sees that the new ones are perfect, and that the old are kept in perfect repair?—It is so; and no lamp is allowed to be carried into the mine without passing through his hands.

Is that examination daily?—It is.

Does the miner leave his lamp with this man always on leaving his work, and receive the same, or another, on the following morning?—Generally so; in some cases the miners have to clean their own lamps, and have the care of them; and in other cases they are left under-ground: there is, however, always a degree of dampness in some mines, and in some instances it is better that they should be taken out of the mine than left there; but in both instances the lamp is not carried into the workings of the mine without being taken to the man to inspect it.

Are the lamps cleaned by brushing?—Yes.

Has not that a tendency to widen the meshes?—Only mechanically, by wearing away the wire, which would be a long operation.

Are not the transverse filaments liable to slide upon the perpendicular ones?—I have seen wire where the perpendicular wires were nearly straight, and the transverse ones bent over them; in that case the transverse wires were very liable to slide over the other; but in wire properly formed, where the bend is equal in both warp and woof, that liability does not exist.

Do not you apprehend that a very great number of lamps have been made with the gauze of the imperfect construction which you have just described?—I have reason to believe that there have been.

Do not you think that lamps with such gauze are peculiarly dangerous?—I think so.

Is there any difference, so far as your knowledge goes, in the price of lamps with the different descriptions of gauze which you have just described?—I believe there is a difference in the price; and I believe, in that case, the imperfect gauze is of a lower price than that which is properly constructed.

Do you consider any economy in such a matter justifiable on the part of the viewer, or the man who takes care of the lamps?—I think not; and I cannot believe that the use of this wire, if known to the viewer or coal-owner, would be sanctioned.

Do you apprehend that it could escape the observation of a man well acquainted with lamps, and accustomed to the care of them, that the gauze was made on this inferior scale?—I think it might.

---

* *Proposed by Mr. Ayre, of Newcastle.*

Would he not be likely to detect it on the first application of the brush, to remove extraneous particles?—No; I think the wire I saw was not so bad as to cause it to slide with the operation of brushing; I think it would require a greater force to cause it to slide, but even that was most dangerous.

Do not you think that a lamp suddenly coming in contact with a piece of coal might have the meshes so deranged as to endanger explosion, having imperfectly-formed gauze?—I think scarcely; the men generally are not so careless of their lamps as to risk such an accident; it could only be done very negligently or wilfully.

In case of any accident, by carrying a lamp through a bord, might not such an occurrence take place, and not be observed when the lamp came afterwards to be lighted?—It might; such a case might happen.

(To be continued.)

◆

NOTES AND NOTICES.

Mechanical Origin of the Foley Family.—The most extraordinary and the best-attested instance of enthusiasm, existing in conjunction with perseverance, is related of the founder of the Foley family. This man, who was a fiddler, living near Stourbridge, was often witness of the immense labour and loss of time caused by dividing the rods of iron necessary in the process of making nails. The discovery of the process called splitting, in works called splitting-mills, was first made in Sweden, and the consequences of this advance in art were most disastrous to the manufacturers of iron about Stourbridge. Foley, the fiddler, was shortly missed from his accustomed rounds, and was not again seen for many years. He had mentally resolved to ascertain by what means the process of splitting bars of iron was accomplished; and, without communicating his intention to a single human being, he proceeded to Hull, and thence, without funds, worked his passage to the Swedish iron port. Arrived in Sweden, he begged and fiddled his way to the iron-foundries, where, after a long time, he became an universal favourite with the workmen; and from the apparent entire absence of intelligence, or any thing like ultimate object, he was received into the works, to every part of which he had access. He took the advantage thus offered, and having stored his memory with observations and all the combinations, he disappeared from amongst his kind friends as he had appeared, no one knew whence or whither. On his return to England he communicated his voyage and its results to Mr. Knight and another person in the neighbourhood, with whom he was associated, and by whom the necessary buildings were erected, and machinery provided. When at length every thing was prepared, it was found that the machinery would not act; at all events, it did not answer the sole end of its erection—it would not split the bar of iron. Foley disappeared again, and it was concluded that shame and mortification at its failure had driven him away for ever. Not so; again, though somewhat more speedily, he found his way to the Swedish iron-works, where he was received most joyfully, and, to make sure of their *fiddler, he was lodged in the splitting-mill itself. Here was the very aim and end of his life* attained beyond his utmost hope. He examined the works, and very soon discovered the cause of its failure. He now made drawings, or rude tracings; and having abided an ample time to verify his observations, and to impress them clearly and vividly on his mind, he made his way to the port, and once more returned to England. This time he was completely successful, and by the results of his experience enriched himself and greatly benefitted his countrymen. This I hold to be the most extraordinary instance of credible devotion in modern times.—*Letters, Conversations, and Recollections of S. T. Coleridge, Esq.*

Test of Gas.—A solution of acetate (commonly called *sugar*) of lead spread upon white paper, affords a very ready mode of ascertaining the purity of gas. If the paper be exposed to the stream of pure gas, it retains its whiteness; but if the gas be impure, it will produce a different shade, according to the degree of impurity, varying from a light brown to a black. Such impurities have the effect of cloying the tubes, and injuring the burners—circumstances tending to make *cheap* gas beneficial to gas-fitters, and therefore very *dear* to consumers.—*Matthews' Gas-Lighting Projects.*

Institute of British Architects.—The first meeting of this Society for the present session was held on Monday evening, J. P. Papworth, Esq., in the chair. Amongst other proceedings, part of an essay on concrete was read, which had been forwarded in consequence of the offer of a premium, and to which the Council awarded a favourable decision, subject to the approbation of the Members. Mr. Fowler also read a series of communications from Messrs. Smiths, extensive builders in Scotland, in answer to the queries issued by the Society. By these gentlemen the first chain foot suspension-bridge was erected in 1817, over the Tweed in Roxburghshire, the span being 261 feet, at an expense of 560*l.* Prior to this a wire-bridge had been erected in Selkirkshire, of 100 feet span, at an expense of 25*l.* (?)—*Morning Chronicle.*

Improvement in Mails.—A Mr. Monteith, in a letter upon this subject in the *Morning Chronicle*, suggests, that the mails should be carried by curricles instead of coaches, taking letters and newspapers only, besides the driver and guard—no passengers—similar to those light vehicles which at present carry the mail-bags a part of the road.

The King of the French has put his name at the head of a subscription for raising a monument at Strasburg to the memory of Guttemburg, the inventor of printing.—*Times.*

Communications received from Mr. Walker—Clovis—Jonathan—Mr. Lunt—G. P.—An Old Sub.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price 6*d.* Also, the volume complete, in boards, price 9*s.* 6*d.*

☞ Patents taken out with economy and despatch; Specifications prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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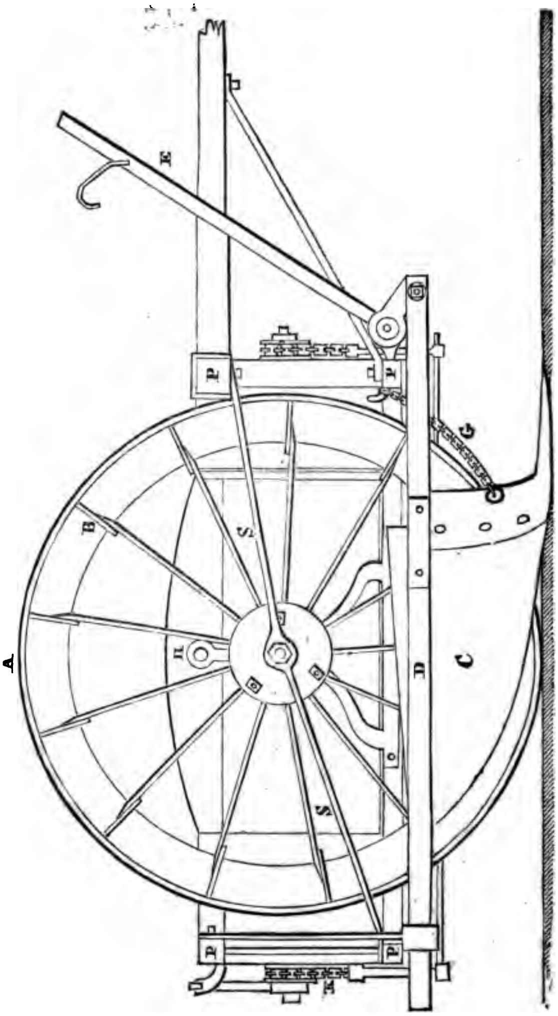


PALMER'S PATENT EXCAVATING AND SELF-LOADING CART.

PALMER'S PATENT EXCAVATING AND SELF-LOADING CART.

In this railway age, an invention which is represented to be capable of effecting a saving of no less than "500 per cent." in the time and labour attending those fundamental railway operations, cutting and embanking, will be readily allowed to be one deserving of all possible attention. Whether so prodigious a saving could be actually realised by the apparatus we are about to describe, practice only can determine; and, for the present, we are inclined to think that to expect so much from it, is to take rather a sanguine view of its capabilities. But we are sure every mechanical reader will join with us, at all events, in admiring the ingenuity and skill with which it has been constructed.

Fig. 1 is a side-elevation of Mr. Palmer's excavating and self-loading cart; fig. 2, an end-view; and fig. 3, a sectional view through the axle.

The cart, it will be seen, is of the ordinary size; it may be drawn by one or two horses, and will hold half a ton. A A (fig. 2) are the wheels, the rims of which are hollow, open on the inside, and divided by the projecting partitions B B into as many separate chambers as there are spokes; C C are iron cutters or excavators, resembling plough-shares, one to each wheel, which scoop out the earth and throw it upon the projecting partitions B B, which, as the wheels revolve, discharge the earth into the body of the cart H; D is a beam, to which each excavator is secured by two strong bolts; and E, a lever, with a hooked termination, to which a chain G, proceeding from the excavator D, is attached, so that by the turning of this lever the excavator may be adjusted to any depth required, or raised altogether when the cart has completed its load. The means provided for emptying the cart are shown in fig. 2. The bottom is divided into two parts I I, which are connected by the bars K K to a chain L, which passes round a projecting iron rod or pulley N. M is a winch-handle, which, being applied to the rod N, opens or shuts the bottom leaves of the cart at pleasure. P P are strong horizontal bars, made fast to the body of the cart, both in front and at back; R R, diagonal braces, which connect the upper and lower bars P P; and S S, braces, proceeding from the nave of the wheel to the bars P P. On the uppermost of these bars, immediately above the letter O, there is is a stopper to retain the winch-handle when necessary.

The cart is stated to have been "seen at work by many engineers, who have all given their most decided approbation of it." A model of it may be seen at Mr. Hendries', in Oxford-street.

Mr. George Vaughan Palmer, the inventor, is now, we regret to say, numbered with the dead. In a slight biographical notice of him, with which we have been favoured by a friend, it is stated that he was a native of Worcester, where he was born, June, 1786; and a descendant of the ancient family of the Vaughans of Trebaried, county Brecon, and Hargest Court, Herefordshire. From early infancy he evinced a strong taste for mechanical pursuits; and had he been longer spared to the world, would probably have risen to eminence as an inventor. Great part of his time was devoted, for some years previous to his death, to the construction of his excavating-cart; and he had but just completed, and secured his right to it by a patent, when he was seized with a rapid decay, of which he died in June, 1834, leaving a widow and four children, for whose benefit the patent is now to be sold.

Fig. 2.

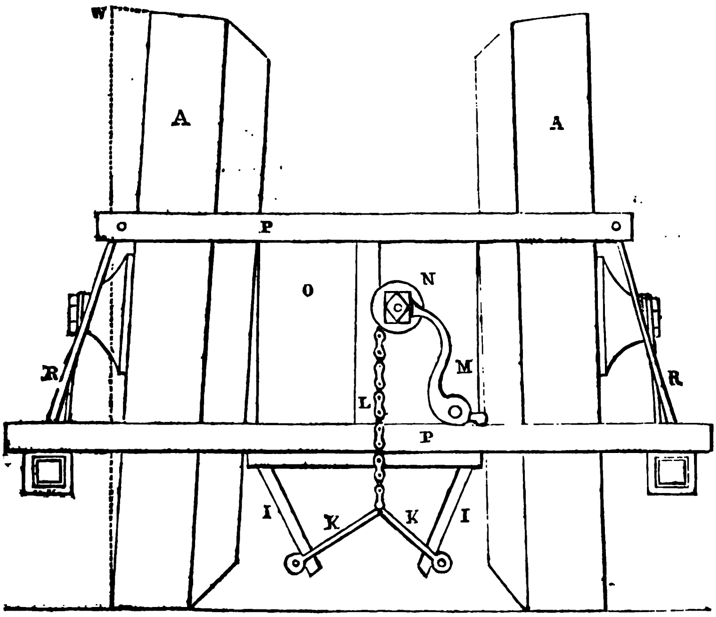
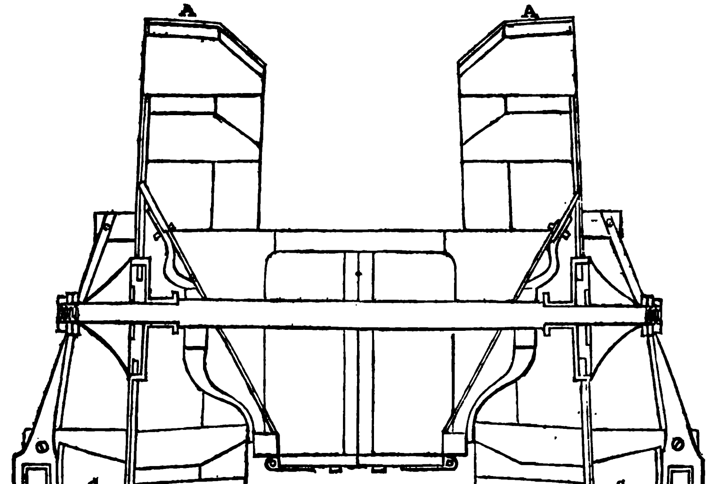


Fig. 3.



WHALEBONE STEEL-PEN HOLDERS.

Sir,—Perhaps your readers may like to know, that whalebone holders for steel pens are far superior to all others. The elasticity of whalebone, so similar to that of a quill pen, very much relieves the hand; and any one may write as much as with a quill, without the fatigue, strain, and pain, on the hand and wrist, occasioned by the usual wood or ivory holders.

Yours, &c.

JONATHAN.

Dec. 31, 1835.

ELECTRICAL THEORY OF THE UNIVERSE.

BY MR. THOMAS S. MACKINTOSH.

Article II.

In the concluding part of our last paper we remarked, that in treating of the moon's approximation we should be enabled to draw our arguments and inferences from two sources, astronomy and geology. Let us examine, in the first place, what support our theory derives from astronomy. We have laid it down, that if two or more comets settle into the planetary state about the same period, the larger attracts the smaller to its sphere, and these become its secondaries. Now, a slight glance at the planetarium, or a scheme of the planets, will at once convince us of the extreme probability of this assumption. Here we see the planets and satellites in the following order and proportion; the number of moons are found in regular gradation, corresponding with the age of each planet, with only one exception, but even this disappears when viewed in connexion with the other parts of our theory; this exception is Mars, and the asteroids or minor planets. Mars has no satellite; and the asteroids, which are no larger than satellites, and appear, from their situation, as if they ought to have been attached to Mars, revolve in orbits round the sun like the primary planets. According to our hypothesis, this exception to the general rule admits of an easy explication. From the relative situations of Mars and the asteroids, the former appears to have settled at a period too remote to admit of the latter coming within the sphere of his *attraction*; nor are they, from their equal magnitudes, capable of attracting each other. If we allow this explication, the whole series will stand as follows, taking Mars and the asteroids as a planet and his satellites:—

Primaries.	Distance from Sun in Miles.	No. of Moons.
Mercury..	36,000,000	0
Venus....	68,000,000	0
Earth....	95,000,000	1
Mars	144,000,000....asteroids ...	4
Jupiter ..	494,000,000	4
Saturn ...	906,000,000	7
Uranus...	1822,000,000	6

Had the minor planets been attached as satellites to Mars, it is probable, judging by his distance from the sun as compared with the Earth and Jupiter, we should not at this time have found more than two remaining. We would also remark, that it is by no means improbable that Mars was attended by one or two satellites during the early stage of his planetary existence. It is further to be remarked, that Uranus, the most distant, and, according to our theory, the most recent of all the known planets, is represented as having only six satellites to accompany her, being one less than Saturn. But this number only represents the satellites of Uranus that have been discovered hitherto. Astronomers are agreed, that, with more powerful instruments, it is extremely probable that several more might be discovered. Upon the whole, we are satisfied, if this table be considered attentively, in conjunction with the foregoing hypothesis, that the truth, or extreme probability of our theory, is a conclusion that must press itself very closely upon the mind.

In the older astronomical works we find the moon's mean distance from the earth set down at 240,000 miles; whilst in the more recent works it is valued at 235,000. It is said that this difference has arisen from the imperfect means of observation possessed by the early astronomers; and that the moderns, with more correct instruments and improved modes of observation, have been enabled to calculate the mean distance with more accuracy, and that, therefore, the modern calculation is a much nearer approximation to the truth. To a certain extent this may be the case; but when we consider that Thales, the philosopher, was enabled to calculate and foretell an eclipse 600 years before Christ, it would appear that the ancients had a more extended knowledge of astronomical science than is generally conceded them by the moderns. It is inconceivable that the early astronomers, excelling as they did in mathematical knowledge, should, in computing the moon's mean distance, have committed an error amounting to a 48th part of the whole value; especially when it is considered that the moon's distance, astronomically speaking, is comparatively small, and might be ascertained, with tolerable accuracy, by observations on her horizontal parallax.

We are, therefore, induced to conclude, that this difference has arisen, to a certain extent, from the moon's approximation. If we had a true and invariable standard of time to which we could refer, it might possibly furnish us with a datum whereby to determine the rate of the moon's approximation. According to our theory, the moon's rate of motion in her orbit is a continually increasing quantity, and the mean time from node to node is, consequently, continually decreasing. But as the earth is also subject to the same laws, it is evident that her motions and time must also vary in a direct ratio with those of the moon; and, therefore, a true measure of the duration of time cannot be obtained by assuming as a standard the period of the earth's annual revolution, or that of the moon, or, indeed, of any *single* planet in the solar system. If the true time of *all* the planets were carefully ascertained and compared with each other, we might obtain a *mean time* that should approach very nearly to the truth. But perhaps the only true and unvarying standard of time in the solar system is to be derived from the sun's rotation on his axis; as, from his situation in the centre of the system, he is not affected by the same causes, it is probable that his rotary motion is uniform and constant.

It would appear, also, that even the motions of the earth, as compared with each other, are not constant and uniform; that the velocity in her orbit is increasing, whilst the diurnal *motion* remains stationary, or perhaps, agreeable to our theory, we ought to say, that the latter suffers a retardation. In the time of Julius Cæsar, the length of the year was settled at 365 days and 6 hours; and in the time of Pope Gregory XIII., in 1582, it was found that the equinox had gone backwards 10 days, in consequence, as it was supposed, of the year having been fixed at too great a length; it was, therefore, determined that the calendar should be reformed, and the length of the year was settled at 365 days, 5 hours, 48 minutes, and 51·6 seconds. This was done by the ablest men in Europe with great care and circumspection, and after extending their observations throughout a long series of years; and yet it has lately been discovered, as appears in Dr. Playfair's "System of Chronology," that the Gregorian year is too long. As usual, this discrepancy is attributed to the reformers of the calendar, and no one seems to suspect, that the year is gradually becoming shorter. It may be objected, that the difference is extremely small as compared with so long a period. But we must recollect, that all the works of nature are carried forward by slow, sure, and imperceptible degrees; and, therefore, the smallness of the difference only shows, that this work is in strict conformity with all her other operations.

Our theory assumes, that the planets and satellites are maintained at their respective distances from the sun and each other by the relative quantities of positive and negative electricity with which each is charged, or, in other words, by the solid contents of matter contained in each, and the quantity of electric fluid with which that matter is charged or saturated. Now, as we can determine by experiment the exact state of two electrified bodies by the attractive and repulsive forces which they exert on each other—and we know that these forces follow the same law as to the intensity of the fluid, namely, the inverse ratio of the square of the distance—this might furnish us with a rough datum for ascertaining the moon's electrical state, that is, how far she has receded towards a complete negative condition; and as the power which she exerts upon the tides is governed by the same law that regulates her own distance, we might, by carefully estimating the *difference* of her attractive and repulsive forces in apogee and perigee, be enabled to obtain a tolerably correct measure of his inductive influence. The ocean may be regarded as a great natural barometer, indicating the state of the electrical atmosphere by which the earth is surrounded; but as it is moved by three forces at the same time—the moon, the sun, and the earth's galvanic circle—all these elements of power must be nicely adjusted before we can expect to arrive at any thing like an accurate calculation.

It is found to be a direct consequence of the law of electrical induction, that "if a small body weakly electrified be placed at a distance from another and a larger body more highly charged with the same species of electricity, it will, as usual, be repelled; *but there is a certain distance within which if it be brought, attraction will take place instead of repulsion.* This happens in consequence of the inductive influence producing so great a change in the distribution of the electricity as to give a preponderance to the attractive forces of the adjacent parts of the two bodies over the repulsive forces that take place in the other parts, and which would have alone acted if the fluid had been immoveable. From this it appears, that when the moon has approached within a certain limit, the repulsive will be overcome by the attractive force, and she will be precipitated upon the earth's surface. We cannot at present pretend to determine this limit, or to speak with any degree of certainty concerning the period that may elapse before this catastrophe takes place. If the principle of this theory were sufficiently investigated to enable us to deduce with precision the electrical states of Jupiter and Saturn, we might perhaps be able to draw conclusions from the respective distances of their satellites with regard to this point; but, in the present state of our knowledge, we can offer no data that could be at all relied upon. However, we will give a table of all the known satellites in the solar system, with their respective distances from their primaries, as affording a reasonable ground of hope, even granting the truth of our theory, that such a catastrophe will not take place for a very considerable period of time.

Mean Distance of the Satellites, the Radius of the Primary being 1.

	1st	2nd	3rd	4th	5th	6th	7th	DISTANCE IN MILES.						
Earth	60	..	..	..	..	..	..	235,000	..	..	..	..	..	..
Jupiter	$5\frac{8}{10}$	$9\frac{1}{4}$	$14\frac{3}{4}$	$25\frac{14}{20}$	..	..	..	247,000	397,000	632,000	1,113,000	..	..	..
Saturn	$3\frac{1}{10}$	$3\frac{19}{20}$	$4\frac{3}{10}$	$6\frac{1}{4}$	$8\frac{1}{4}$	$20\frac{1}{4}$	$59\frac{17}{20}$	124,000	158,000	196,000	250,000	350,000	810,000	2,394,000
Uranus	$13\frac{1}{10}$	17	$19\frac{17}{20}$	$22\frac{1}{4}$	$45\frac{1}{2}$	91	..	129,000	297,000	347,000	379,000	776,000	1,569,000	..

It appears from this table, that the mean distance of the first, or nearest satellite of Saturn, is $3\frac{1}{10}$ the radius of the primary, or 124,000 miles. We may, therefore, consider that this satellite, being the nearest to its primary, will be the first to disappear from the solar system. As its final precipitation will be instantaneous, it is by no means probable that it will be observed from this earth. But at whatever future time it may be discovered that Saturn is attended by no more than six satellites, such discovery must be regarded as a demonstration of the truth of this theory.

Perhaps our hypothesis may be allowed to derive further support from the following statement:—In the year 1823, upwards of fourteen years ago, conversing with some friends upon this subject, we offered to rest the proof of its truth upon the appearance of Halley's comet in 1835. According to our theory, the comet's tail is gradually absorbed and becomes shorter in each successive revolution. We predicted that its appearance would be found to correspond with our theory; and that it did so is well known to all the astronomers of Europe.

In the early accounts of this comet it is described as "the comet of horrible aspect, whose tail extended from the zenith to the horizon;" and yet we find in 1835, that it is scarcely to be discerned with the naked eye.

It is also assumed in our hypothesis, that the earth is gradually becoming denser, and that her diameter is, consequently, decreasing; if this should prove to be correct, it will be found in the course of a few ages, that a pendulum vibrating seconds in the latitude of London, will not agree with the standard of our imperial weights and measures, which was settled and adjusted by the pendulum of Captain Kater. Of course, the French standard, being a degree of the meridian, will be affected by the same cause. In short, there is nothing stationary in nature; when men seek a standard that shall be stable and unvarying, they seek that which is not to be found; and we have even put it seriously to our own mind, whether the sun himself does not revolve in an orbit with his whole system of planets round him, like the satellites of Jupiter or Saturn.

There is no occasion that we should feel *any undue alarm from* the supposition of the earth and moon coming in collision; we are in the hands of an all-ruling Providence, and he will deal with us as unto him seemeth good. Death's thousand doors stand open, and this is not more terrible than the others through one of which we must pass. And if we consider, for a moment, the state of famine and misery that must ensue were the generations of men allowed to stretch out until the earth, exhausted and worn out, became unable to yield her fruits for their support, we will be constrained to acknowledge that such a consummation of the human race can be regarded in no other light than a wise and merciful dispensation of Divine Providence.

The geological observations will be given in another paper.

Note.—In the last article, *Mech. Mag.* No. 645, there is an error of considerable importance. It is stated in p. 228, "that if the electric fluid be withdrawn, matter has an affinity for and will attract other matter;" this is wrong, it ought to have been, "that matter deprived of its electricity will repel other matter."

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GALLOWAY'S PADDLE-WHEEL.

Sir,—Being a regular reader of your publication, I have perused your remarks on Galloway's new paddle-wheel. I know not the size of the Rose and Monarch, to which these wheels are fitted in London, but I am able to say, that they have been tried on our first-class vessels at this port; and I understand the City of Dublin Company are so much pleased with their performance, as to have purchased a license from Mr. Galloway to use them to all their vessels. They are now fitting the Commerce and the City of Limerick, of 200-horse power each; and Sir John Tobin, who is a large steam-boat proprietor, is also fitting the Margaret, the largest steamer ever built at Liverpool, and of 300-horse power. I went on board the Huskisson, 180-horse power, which was fitted experimentally with Mr. Galloway's wheel, and every person on board spoke in the highest terms of its performance. The back-water is very much reduced; the trembling motion totally removed; and a head-sea did not appear to affect the uniform motion of the engine. The engineer said he would not like to be without them under any circumstances.

feel assured that you will gladly give insertion to this testimonial, which may be the means of removing those doubts which you have expressed regarding the efficiency of this wheel.

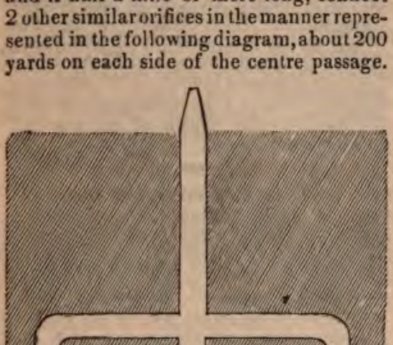
I am, Sir,
Your obedient servant,
Robert Williams.

13, Hill-street, Liverpool,
Jan. 5, 1836.

◆

VENTILATION OF TUNNELS.

Sir,—I think the following plan for ventilating tunnels would be an improvement upon that which I have seen generally recommended. If the tunnel is one-fourth of a mile long, let a circular orifice be made, 12 inches in diameter, from the centre of the top to the surface; and if half a mile or more long, connect 2 other similar orifices in the manner represented in the following diagram, about 200 yards on each side of the centre passage.



These auxiliary orifices rising about five or six feet before passing to the principal, at not more than one-third of the width from the sides. Under each passage there should be placed a strong gas-light lamp; so that all three lamps would be seen at either end. The main passage should, at two feet from the surface, pass through a fire in a close iron stove, with a continuation or funnel of *three or four feet, contracted at the top to about four inches diameter.* In this way an excellent ventilation would be produced at all seasons, from the strong current always rushing up to the rarefied part.

I am, Sir,
Your obedient servant,
G. L. Smart.

Enfield, Dec. 4, 1835.

Postscript to the preceding Communication.

Sir,—Upon the subject of ventilation of tunnels for railway purposes, I beg to add the following suggestion to the communication I sent you lately upon this head. It has been observed by Dr. Lardner and others, that the velocity of the train would probably cause the unconsumed gas to rebound from the roof upon the passengers. The method I before stated of constructing the shafts would promote perfect ventilation; but I would also furnish the roof of the tunnel with boards, two feet wide, placed across at an angle of 45°, a foot apart, and the same from the roof; the whole of the boards to incline to the centre shaft. I think there would be a continued current of fresh air above these boards from each end, which would naturally draw up and carry off the noxious air caused by the steam-engine.

I will take this opportunity of saying, that I cannot but regret that there are men who are capable of venting sarcasm upon suggestions offered by others, purely from a wish to promote public benefit. Such treatment has a tendency to check the progress of science; for, it must be admitted, theorists often advance crude ideas, that afterwards get matured and become of essential advantage to society. These remarks are in consequence of Mr. Thomas Deakin's strictures, in No. 641, upon my propositions for the Thames Tunnel; but I feel gratified that, although the plan, or rather the means, suggested by me were by far of too slight a nature, the precise method is being pursued with success, as the elaborate and gentlemanly letter of your correspondent, in No. 638, upon the subject shows.

I remain, Sir,
Your obedient servant,
G. L. Smart.

Enfield, Dec. 21, 1835.

MR. HERAPATH'S AND IVER M'IVER'S RAILWAY THEOREMS.

Sir,—Having watched with some interest the discussion between Iver M'Iver and Anti-Carper, relative to the locomotive theorems of your scientific correspondent Mr. Herapath, and having seen some calculations on the velocities of locomotive engines, by Dr. Lardner, given in evidence against the Great Western Railway, I was induced the other day to amuse myself with comparing the theorems of Messrs. Herapath and Iver M'Iver with the calculations of Dr. Lardner. The results were so very curious, as bearing on the point in dispute, that I have selected the two following cases, which will help, I dare say, to enable your less scientific readers to make up their minds respecting which of your disputants is right.

I beg to disclaim all intention of mixing myself up in this controversy; I merely give the results as facts to speak for themselves.

It should be observed, that Dr. Lardner makes the plane of repose 1 in 250, and the maximum velocity on a level 25 miles an hour; Mr. Herapath, 1 in 240, and 30 miles an hour. The latter gentleman's theorem, p. 183, vol. xxiii., for the speed being altered to suit this, will become $\frac{25 \times 21{\cdot}12}{21{\cdot}12 + h} = \frac{528}{21{\cdot}12 + h}$ for the velocity in miles per hour up hill, and $\frac{528}{21{\cdot}12 - h}$ down hill, h being the inclination in feet per mile of the plane. Iver M'Iver's formula, as given in his last letter, p. 251, for the velocity in miles per hour on a descending plane, is $\sqrt{V^2 + 2gh} \cdot \frac{15}{22}$, where V is the starting velocity in feet per second down the plane, $g = 32\frac{1}{6}$, and h the total fall in feet of the plane; V is therefore $= 36\frac{2}{3}$, if the starting velocity is 25 miles an hour. If it be an ascent, h, as Anti-Carper rightly observes, will be negative.

The two cases alluded to are that of a plane 159 chains long, whose height is 11 feet or 5·535 per mile, and of a plane 707 chains, whose height is 49 feet or 5·543 per mile. I have selected these cases, because the heights of the planes being so different with nearly the same inclination, are well calculated to elucidate the merits of the rival theorems, but all my other calculations are equally favourable to Mr. Herapath's theorem, and unfavourable to Iver M'Iver's.

PLANES.			Velocities up in Miles per Hour.			Velocities down in Miles per Hour.		
Length in Chains.	Total Height in Feet.	Height per Mile in Feet.	Lardner.	Herapath.	Iver M'Iver.	Lardner.	Herapath.	Iver M'Iver
159	11	5·535	19·83	19 81	17·21	33·83	33·88	30·89
707	49	5·545	19·82	19·80	Imaginary.	33·85	33·90	45·72

The almost perfect coincidence here shown in every case between the two eminent mathematicians, Dr. Lardner and Mr. Herapath, can leave no doubt but that both are right, and that both use the same theorem. The difference (in no instance exceeding the twentieth of a mile) may be caused by my going to a greater or less accuracy in the decimals of the height of the plane per mile in the third column.

Iver M'Iver's great deviations in every case (near 12 miles in one), and the absurd result in the ascent of the longer plane, must be satisfactory proof that he is wrong.

Though, as I have stated, I do not intend to take part in this controversy, it is but an act of justice to say, that Mr. Herapath has the merit of having given the first *direct* solution to the problem of finding the relative velocities of a locomotive-engine carrying different loads on a plane, and up different inclines, which he did, it seems, from his own physical discoveries, in your Journal for June 13, 1835, p. 183. A similar result might have been obtained from analogical inference, but perhaps no other mathematician could have *directly* solved the problem. Dr. Lardner, in his calculations, given in evidence before the Lords, August 3, seems evidently to have used Mr. Herapath's theorem; but, no doubt, not before he had thoroughly investigated it, and satisfied himself that it was correct. It is a curious fact, that, though Mr. Herapath discovered the theorem, he limited it to levels and ascending planes, and Dr. Lardner was the first to use it in descents, and to fix the limiting velocity (40 miles an hour) of its application, which Mr. Herapath, in his 9th letter, published August 29, confirms.

Yours respectfully,

A LOOKER-ON.

London, Jan. 4, 1836.

PARLIAMENTARY EVIDENCE ON ACCIDENTS IN MINES.

(Continued from p. 288.)

Examination of Mr. Nicholas Wood, continued:

You have spoken of No. 3, as Dr. Clanny's improved lamp; have you had any opportunity of judging of the merits of that improvement? — Not practically; it is only recently that I heard of it.

What is your opinion of its value, as a practical viewer?—When the Davy lamp is put into an inflammable mixture, it of course becomes red hot, if the mixture of inflammable air is very considerable; if it is kept in such a mixture for a length of time, of course the heat will destroy the lamp, and it will ultimately become unsafe. The practice in such cases is, that the men should not keep a lamp in such a state; they have orders that whenever a lamp becomes filled with flame in the inside, they should withdraw it. Dr. Clanny's lamp, by the brass-wire being burnt away, will of course prevent the lamp from being kept in such a mixture; and so far as regards the use of the Davy-lamp, where it is liable to be filled in the inside with flame, I think it is useful. But I would say, that that is in extremely limited cases, and probably such cases should not exist generally. I think the mines ought not to be worked where they can only be worked with a lamp filled with flame.

Is there any drawback from that benefit in Dr. Clanny's lamp?—I have not had an opportunity in practice to see its operation; but the only objection I see to it, as a matter of opinion, is, that the shield will throw a greater quantity of heat to the upper portion of the wire, and render it more liable to be burnt; to what extent that will operate, or whether that may not be remedied by a different construction, or that it may not exist to such an extent as to render it objectionable in practice, I cannot give a decided opinion. With these exceptions, and the liability of the slides to get out of order, I think Dr. Clanny's invention useful in the cases that I have mentioned.

You have stated that such cases ought not to occur as men continuing their lamps in a decidedly explosive atmosphere; cannot you conceive a case of a man just on the point of bringing down his coal being tempted to allow the lamp to remain a few minutes, or in the case of his having nearly filled his basket or corf, most imprudently continuing his lamp in that dangerous situation?—I believe that such cases may occur in a mine that is highly charged with gas, where the common lamp may become filled with flame, and yet may be used with safety; still cases may occur that may cause the fire-damp to come into that mine in such quantities that it may be filled with flame for a considerable time, and where such cases do occur, Dr. Clanny's lamp may be useful.

At the same time you admit that it would be in the power of the workman to prop up the shields?—I think it is.

If he was so wilfully disposed?—Yes.

Do not you think that such a lamp is of great benefit to the wasteman, in his morning examinations of the state of the mine, or in exploring abandoned parts of the mine?—I think in exploring the mine in the morning such a lamp is not so useful, on this account, that the people that have charge of that operation are generally men who are selected for their caution, and those men would not use the common lamp in such a case improperly; they would not carry it to such an extent as to let it be filled with flame, and continue for that length of time which would injure it.

Do you agree in the statement that great risk may arise from a person carrying the original Davy-lamp at a quick pace through an inflammable atmosphere?—So far as my own experience goes, I do not know that carrying it at a considerable velocity would cause the flame to pass through the wires. Sir Humphrey Davy's experiments go to state that such is the fact. I have never seen lamps carried, even in mines where there is no great risk, with that velocity which would cause it to pass through, if such a case is possible; and I cannot conceive that any man in a mine, where it was dangerous, would put a lamp to such a test, unless it was done wilfully.

Are you not bound to suppose a case of the judicious wasteman, not at the moment apprehending the explosiveness of the atmosphere in which he was working, being thus suddenly reminded of what he had not before apprehended?—I think such a case may exist, if the flame is not visible before the wire is burnt in two. I would say that I think it important to know whether the common Davy-lamp, by the elongation of the flame, shows the existence of inflammable air before the wire is burnt in two in Dr. Clanny's lamp, of which I have not had an opportunity of experimenting. In the hands of a careful workman, if the elongation of the flame precedes the burning of the wire, that workman should depend upon the appearance of the flame rather than upon Dr. Clanny's lamp as showing the existence of inflammable air; but in the hands of the majority of workmen not so careful, Dr. Clanny's lamp may be useful.

But the most careful workman at his work may not be observing his lamp?—Yes.

And the shields become a watch for him in that case?—Yes.

To Dr. Clanny.—In your lamp, the effect of the shield dropping is to exclude the inflammable air, but not to affect the oil-lamp light?—Precisely.

Is the oil-lamp then extinguished?—It is not, and for the reasons I will give; when the inflammable air is in communication with the flame of the oil-lamp, a blue flame plays within the wire-gauze cage, this blue flame immediately fuses the piece of wire passed through the cage, and at that moment the safety-shields fall by their own weight; a small perforation is made at the bottom of the outer or lower shield on each side, through which a sufficient quantity of atmospheric air containing inflammable air at the inflammable point, penetrates and maintains the flame of the oil-lamp only.

You have heard the opinion of Mr. Wood, that there may be an increased heat in the upper part of the lamp, in consequence of its being covered with those shields, and in that way endanger the wire; what is your answer to that?—I am much obliged to the Honourable Chairman for putting that question, for I am sure that Mr. Wood, the witness, will be satisfied upon that point when he observes that the upper shield leaves the wire-gauze, to the extent of three quarters of an inch above the said safety-shields, which will keep the cylinder cool enough, and in the course of my experience I never found any additional heat in using this lamp.

To Mr. Wood.—Have you any further observation to make on Dr. Clanny's improvement?—I would observe, that the objection which I have stated against Dr. Clanny's lamp is not with any intention of detracting from the merit of that lamp, because I think it is well worthy the attention of the coal-*owners; I only made those objections* because I think that in all those cases the utmost caution should be used before a decisive opinion, in such dangerous circumstances, is expressed upon any plan.

You stated that your objection was matter of opinion, and not founded upon any experiment?—It is; I think it well worthy of further inquiry and attention.

No. 4 the Committee understand to be a Davy-lamp, with a glass chamber?—It is.

Will you describe what you conceive to be the advantages from the introduction of the glass chamber?—As I have stated before, the Davy-lamp becomes filled with flame from the construction admitting the air to pass into the lamp, over the whole surface of the gauze; the glass chamber is for the purpose of diminishing the quantity of air which passes into the interior of the lamp.

Is the glass ground at the bottom, so as to fit closely on the upper part of the lamp?—There are two constructions of lamp which I have; No. 4 I have used at Killingworth and at Springwell colliery for a considerable time.

Is there any thing besides the glass chamber peculiar to No. 4?—No. 4 is the common construction of that lamp; the construction of that lamp is objectionable in some respects, because the man may open the lamp even though a lock is put upon it. No. 5 is an improvement upon that construction, by which the lamp may be completely locked, in the same way as the Davy-lamp, and prevent the man from taking the top off.

Is not the structure of this improved Davy-lamp rather reverting to Mr. Stephenson's original lamp of 1815, which was insulating the flame by a glass chamber, and communicating with the external air by small orifices?—I should say that the lamps, Nos. 4 and 5, with the glass which we are describing, without the gauze, is of the principle of Mr. Stephenson's lamp of 1815.

Then you consider the glass tube particularly advantageous in cases where any thing should occur to destroy the gauze?—I should say that the part of the lamp which I have most dependence upon, as regards safety, is the wire-gauze, inasmuch as the glass is liable to be broken; I think the glass extremely useful in contracting the current of the air, and keeping the wire always in a perfect state.

Do you mean to say, that practical observation satisfies you, that with that glass, and the flame in an insulated state, there is no more combustible air admitted through the small aperture at the bottom, than is necessary to feed the lamp?—Not more; it contracts the quantity of air admitted into the interior of the lamp, and that is extremely useful in many instances, I believe that this lamp is put out before the Davy becomes red-hot; that it is put out by an atmosphere which would not heat the Davy-lamp red hot; and that it will not burn in an atmosphere where the Davy-lamp would become red hot. In some degree it operates, as it were, in the same way as Dr. Clanny's lamp, showing the existence of the mine in a very inflammable state.

That is to say, that the limited quantity of gas of any description which is admitted, operates, in the case of very foul air, as an extinguisher to the lamp?—It does; and I have tried the two lamps together; the lamp with glass was generally put out before the Davy-lamp became filled with flame. I must again revert as to Dr. Clanny's lamp, whether this lamp, No. 5, would not, in some degree, be as useful in showing the existence of air of a certain degree of inflammability in the same way as Dr. Clanny's lamp does; as I stated before, I have not the means of judging which of the two would show it first, but I think it extremely important that some lamp, either the one or the other, could be used for such a purpose; on the other hand, on going into an inflammable mixture, which is merely inflammable, or just upon the point of inflammability, the Davy-lamp shows the existence of inflammable gas sooner than this lamp with glass; it is more apparent to observers.

Then under all the circumstances of the case, not having experimented upon Dr. Clanny's lamp, you consider No. 5 to be decidedly the nearest to perfection of any lamp which you have hitherto had an opportunity of examining?—Yes, as being put out when the air in the mine is in the highest state of inflammability.

And on that account the safest lamp in highly inflammable mines?—I do not know whether it is absolutely safe or not; I have paid considerable attention to those things, and I find in chemists so great a difference of opinion upon the point, that I am in some doubt myself whether it is nearest perfection or not; on this account, I shall take an extract from Sir Humphrey Davy's work, and from another work on the same subject. Sir Humphrey Davy's opinion, as shown in that extract, would go to state that No. 5 is not safe, Sir Humphrey Davy says in his work on safety-lamps——

What work are you about to quote?—It is a work "on the Safety-lamp for Coal Mines, by Sir Humphrey Davy," published in 1818, by Hunter, of St. Paul's Church-yard; he states in p. 19, that "if mixtures of fire-damp are burnt from systems of tubes or canals, or metallic plates, which have small radiating and cooling surfaces; though these systems are safe at first, they become dangerous as they are heated;" and in a note, he says, "I warn the coal miner against any *pretended safety-lamps made* in this manner, and which to superficial observers may appear to be constructed upon principles of security, but in which those principles cannot really exist." That is one portion of his work; Sir Humphrey Davy's theory of the principle of safety of his safety-lamp, is the wire acting as a radiating power, and also as a conductive power, and inasmuch as a flat plate perforated with holes, there is not the same radiating surface, therefore a lamp so constructed is not safe, according to Sir Humphrey Davy; therefore the safety of the lamp depends upon the radiating power in the wire-gauze.

You are of opinion that Sir Humphrey Davy's theory must be regulated by the extent to which he carries that theory, and the degree of radiation requisite?—I am not competent to judge whether it is a correct theory or not; but I stated that it throws a doubt upon the minds of practical men, whether perforated plates are safe or not; I have no doubt of the safety myself; but it is important that it should be ascertained in a practical way, because another person writing upon the safety-lamp, speaks of the very reverse being the fact; and I think in a very dangerous sort of way.

What are you about to quote?—From a work by Mr. Murray, intituled "Practical Observations on the Phenomena of Flame and Safety-lamps," published in 1833, in which he states in p. 10, "It seems, therefore, evident, that the principle of safety cannot depend upon any cooling influence whatever, whether it be connected with contact or radiation." Now, according to Murray, this lamp, No. 5, would be perfectly safe, though Sir Humphrey Davy gives a different opinion; he goes on to state, "accordingly, it is found that when the safety-lamp is newly lighted, and it is consequently more cool than at other times, it is very apt to explode the air of the mine, and will kindle a stream of hydro-carbonate; under such circumstances, even when six folds of wire-gauze interpose, while it will not permeate one such fold if the lamp be hot;" that is I think the very reverse of the fact of my experience, and it certainly is a very dangerous sort of opinion to be given by a chemist, who I believe is very high in his profession, and coming into the hands of practical men. My reason for giving these extracts, is to show that Sir Humphrey Davy's observations throw some doubt, in my mind, as to the safety of this lamp, though in practice I have tried it in every situation in a mine in which a lamp could possibly be taken, where the transition from good air to inflammable was sudden, and which I believe is the severest test that a lamp could be put to, and I found it never exploded externally; there-

far as practical experience goes, I
ınd it quite safe.

you continued it for any length of
an explosive atmosphere?—I have
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hich is that of the flame being carried
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r. Clanny's lamp is also liable to.

r. *Clanny.*—Have you experimented
e effects upon your lamp in the case
ing rapidly carried through the air?
e, and it goes out instantly, before
time for the flame to pass outwardly
the wire-gauze, were there perfora-
the gauze.

r. *Wood.*—Have you any caution to
in the use of your improved lamp?—
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sing only through the top of the
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able care in seeing that the wire is
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is directed to one point; I consider
lamp more liable to this than Dr.
lamp.

not that be remedied by having a
or cap in addition to the one placed
dinary distance?—There are in this
ee tiers of tops, the copper top, and
non top belonging to the wire, and a
likewise.

sing all lamps to be so constructed,
u apprehend the danger you have
would be effectually guarded against
daily examination?—I cannot go to
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obviated in this improved one; but
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his state; No. 4 is of considerable
in cases where the glass is broken,
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the large cylinder is much more
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t size which he recommends; this
meter was made with a view of the
g liable to be so heated as to crack;
sses are properly tempered, such a
hat produced within it should not
very great effect *upon it*; and it appeared to me that there was no reason why the diameter of the glass could not be reduced, and that was one reason for my making this lamp of a smaller diameter; but still it cannot be made of so small a diameter as that standard which Sir Humphrey Davy states it would be dangerous to go beyond. That is one objection which lamps with glass in the inside necessarily have.

You say that you have tried your lamps in an atmosphere of carburetted hydrogen, that compelled the extinction of the lamp; is there any contrivance by which you could see your way out?—None at all.

Have you made any experiment with the lamp suggested by Sir Humphrey Davy, which had a piece of platina wire ignited at the top, and gave out some lustre after the lamp had been extinguished?—I have tried it in a mine, as an experiment only.

Do you think it could be made an available improvement?—I think it would be required in so few cases, that it would not be practically necessary to adopt such an expedient; it is only to enable a person to get out of the place where he is working when the lamp goes out; but a workman can walk out very easily without a light, and there is no necessity for such an addition to the lamp for that purpose.

Have you ever made any experiments as to the relative proportions of light carburetted hydrogen gas and atmospheric air which form the most explosive mixture?—Yes, I have.

Will you state in numerical proportion the relative quantities of atmospheric air and light carburetted hydrogen gas which form the most dangerous mixture?—I believe a proportion of eight parts of common air and one part of carburetted hydrogen form the most explosive mixture; it becomes explosive when the proportion is 13 to 1, and increases in inflammability till it becomes the proportion of eight to one, then I believe it diminishes in inflammability as the proportion of carburetted hydrogen increases, until it comes to a proportion of three or four to one, when the quantity of atmospheric air is then insufficient to support combustion.

Have you ever tried what the results are in exposing bodies, of iron for instance, in a red heat to those combinations of atmospheric air and carburetted hydrogen?—No, I have not exposed iron red hot to explosive mixtures. I have made the experiment with a candle and with a lamp.

Are you prepared to state whether the gauze of a lamp heated to redness will cause ignition in the surrounding gas?—Not from my experience in mining, though I have seen them red-hot without passing the explosion. I only know it from reading the experiments of Sir Humphrey Davy.

What is your conviction from reading those experiments?—The conviction on my mind after reading those experiments is, that so long as the heat is such that the lamp is only at a dull red heat, it will not explode through the meshes of the wire; if it is increased in intensity of heat so as to nearly fuse the wire, then it would pass the flame, and it would explode in the mine.

Was not Sir Humphrey Davy's opinion that even white heat would not cause explosion?—Sir Humphrey Davy states, "that single wire-gauze of the kind used in the common miner's lamp is impermeable to the flame of all currents of fire-damp, as long as it is not heated above redness; but if the wire be made to burn to a strong welding heat, of course it can be no longer safe; and though such a circumstance can perhaps never happen in a colliery, yet it ought to be guarded against." Then he goes on to instance an experiment made at Lambton colliery upon a blower of gas, where, with a certain velocity of current, and a degree of heat on the inside, the explosion was passed through the wires of the lamp. That is in illustratiod of the opinion he expresses.

Supposing Sir Humphrey Davy's theory and experiment to be correct, can you suppose the gas burning in a lamp so as to produce a white or a welding heat?—I think not. I think the gas in the mines is never in that state as to produce such a heat. I do not know that such a heat could be produced unless there was a very considerable current of that gas; and I do not know of any case where the lamps could be exposed to such a current in an explosive mixture in a mine so as to produce that heat. In this experiment the gas was applied to a very severe test of an inflammable mixture; that is, the gas was mixed with the purest air on the surface. In the mines the air is never perfectly pure, and the gas mixed with impure air will not readily explode. I can mention an instance in a mine where candles burnt with impunity in a mixture of carburetted hydrogen gas and carbonic acid gas, which when brought into and mixed with pure atmospheric air exploded; when the air is very pure, and mixing with the gas, it is then in the most inflammable state, and therefore this experiment only went to prove the cases which occurred at the surface, not in a mine.

Under any circumstances of combination of gases which are to be found in mines, in what period do you suppose actual oxidation of the gauze would take place, and consequent decomposition of the wire?—I think it could only take place where the lamp is kept for a considerable length of time in inflammable mixture; such a length of time as no lamp ought to be kept in a mine, and I believe never is kept in a mine.

Will you give the Committee a more definite idea of "a considerable length of time," according to your own apprehension of the result to be produced?—I should say, that a lamp kept in a state of red heat for a quarter of an hour would not produce injury. I could not state the precise period; for such an assertion might lead to its being kept longer than it ought, and especially as because in the mines my orders to the workmen are, that they are unsafe immediately they become filled with flame.

Can you suppose such accidental circumstances in a mine, as that a sudden current shall set upon the lamp, so as to produce that certain degree of heat which will cause instantaneous explosion?—I should think not, except the lamp was exposed to such a current wilfully; I think the least degree of caution would prevent such a lamp from being exposed in such a way.

Is it not possible, for what has been termed, in a former part of the evidence, "a bag of gas" to explode in the direction of the lamp, so as to produce the effect hinted at in the last question?—Such a case might possibly happen, that a sudden bag of gas bursting out might cause the lamp to explode.

In many of the fatal accidents which have occurred, no one has remained to tell or to afford any reasonable conjecture how the accident happened?—In several of the very serious accidents the men are not left, especially where the explosion is very extensive.

Is it not customary to attribute those accidents, on almost every occasion, to some act of carelessness on the part of the miner?—Knowing that the lamp in almost every case is safe, under ordinary circumstances, and as I can hardly conceive a case, except under very extraordinary circumstances, where the lamp kept whole would communicate explosion, it is generally attributed that, in the absence of every other evidence, something must have happened to destroy the security of the lamp, or that it had been done by carelessness. We know instances of carelessness that might produce such explosions; I myself have had instances of men taking the tops off the lamp, and being discharged in consequence of that, in mines that were inflammable.

But if such carelessness was of very frequent occurrence, should we not much oftener hear of sudden explosions; would not this be a necessary consequence?—It certain would; I should hope that those instan are not very numerous; but I believe that a great many of the pits that are work with lamps the atmosphere is not in an inflammable state at all times, only occasionally; and it is in a great majority of instances more as a matter of precaution against accidents that lamps are used, than that they are absolutely necessary; they are not generally in an explosive mixture, except on few occasions.

But knowing that under certain circumstances those mines are liable to be, temporarily at least, in a dangerous state, no viewer would be justified in allowing such a mine to be wrought with candles, would he?—I think in any mine where such accidents are likely frequently to occur, and where the exposure in consequence of the use of candles would be serious, no viewer would be justified in using candles, such as in working pillars; but in working the whole coal, gas may be thrown out in considerable quantities suddenly, which may produce only a partial explosion if accidentally ignited; in such a case, and where it is necessary for working the coal that it should be blasted, and candles cannot be dispensed with, I think a viewer is justified in using candles.

In illustration of that last answer, have the kindness to produce a plan, which you stated that you had in your possession, proving that such an accident might happen in a bord, or a limited portion of the mine, as in the case of Killingworth colliery?—[*Witness produced the plan.*]—When the accident happened the mine was entirely lighted with candles; the workman was holing the wall, or making a communication between two bords, and when the communication was just about being made, he tapped a back or fissure, which threw out a considerable quantity of gas; there was a small hole made between the bords, by the workman striking his pickaxe through the coal, and immediately the gas was discharged with great force, and ignited at his candle, and burnt his face and hands; no other man, working in any other part of the mine, was injured at all. The explosion was so considerable as to set fire to the wooden partition or bratice in the bords, and it was only extinguished by being shut up. We could get no water to it or approach it for some time, owing to the smoke; and at one time we thought it would have been necessary to shut up a considerable portion of the mine in order to extinguish the fire. The explosion in this case was so little felt throughout the mine, that some men working at about 100 yards distance worked for six hours afterwards in the mine without ever hearing of it; and that occurred in a mine where there was a very considerable discharge of gas, and where, in some states of the weather, the discharge was so great as very nearly to bring the air generally to an inflammable point.

You are aware of many collieries which are not annoyed by the presence of hydrogen gas?—Very extensive collieries have no inflammable gas at all; others have it in a greater or less degree.

Do you attribute that to the circumstance of the works not emitting the gas so much, or to the better ventilation of them?—The slaty coal emits very little gas. Some which have bituminous coals do not emit nearly the quantity of gas that others do; a very great proportion of the collieries in Northumberland and Durham do not produce gas.

Will you state any reason, on the score of economy or necessity, which should induce a miner to employ candles in the Killingworth mine in preference to lamps?—I will explain the reason why I use candles in that mine in preference to lamps; the reason is, the coal is of such a nature that it cannot be wedged down. The mode of working coal is either by blasting or by wedging; the coal of that part of Killingworth colliery is of that hard nature, and the tenacity with which it sticks to the roof is such, that I believe it cannot be worked to profit without blasting; and my reason therefore for working it with candles is, that it would not, with the use of lamps, be worked to profit.

Then in consequence of the necessity of using gunpowder, candles are substituted for the lamp, as occasioning no additional danger or risk?—The necessity of using gunpowder increases the use of candles, and I think in that case, with proper care, candles may be used with safety. The mode of working the colliery is varied, of course, according to the quantity of gas met with; leading drifts in some cases are driven, to tap, as it were, the mine before the general workings approach that part, and, as it were, to explore the danger; and in some degree these leading drifts draw off the gas, keeping the main body of the workings more free from such casualties.

If scientific experiments could satisfactorily prove the possibility of blasting with gunpowder under circumstances such as to prevent ignition to surrounding gas, would you have then any objection, in the case described, to substitute the use of the lamp?—I think not, except so far as regards economy. I believe that the desire of the coalowners is so great to secure safety of the workmen and mines, that I think, to a certain extent, they would not hesitate in using lamps instead of candles, if the miners were to be more safe in consequence; but I have some doubts in my mind whether the general use of lamps in mines that perhaps are never, or very rarely, dangerous by an inflammable mixture, would be a saving of loss of life.

Will you state to the Committee the process of reasoning by which you arrive at that conclusion?—It has always been my impression, that if lamps were generally used where mines are scarcely, if ever unsafe, that it would produce a greater degree of carelessness in the men in the use of their lamps; because although the accidents where candles are used are probably as numerous, or more so, than where lamps are used, yet when an explosion does occur where lamps are used it is generally very fatal. In one part of the mine adjoining Killingworth we were liable to sudden and occasional discharges of gas, and the coal was obliged to be blasted with gunpowder. I enforced the use of lamps by the men, and set other men, in whom confidence could be placed, to fire the gunpowder; but I abandoned this mode of proceeding from the conviction that the mine was much safer by having candles entirely in it than by using lamps occasionally, and setting men to blast the gunpowder; entirely from the experience that any use of the lamp, except where absolutely necessary, produced a sort of carelessness in the workmen.

Are there not many cases in which the mines could not be wrought without the daily and hourly use of the lamp?—There are a great many mines which could not be worked without the use of the lamp, and where lamps are always used; those are principally pillar workings, where the mine does not require to be blasted with gunpowder, and where the discharge is such as to render the mine frequently dangerous. In all those cases lamps are used.

The pillar working is always attended with great danger?—The pillar working renders a mine more inflammable, inasmuch as you cannot produce a perfect ventilation.

Is the value of the pillars sufficient to the proprietor to justify him in encountering that danger?—They are; and I should not say that there is more danger in working the pillars than in working the whole mine, because in that work the lamps are entirely used.

Is it always the practice to get out those pillars?—Always, and in deep mines the pillars constitute three-fourths of the coal, and as a consequence, in those cases three-fourths of the coal would be lost if the pillars were not worked.

For fifteen years have you had an average of 500 men and boys under your superintendence?—Yes.

Can you give the Committee an idea of the number of fatal accidents, in the way of a per centage, that have occurred to 500 men and boys in the last fifteen years?—At Killingworth colliery, which is the most extensive mine under my charge, there are about 300 men and boys employed under ground.

(To be continued.)

NOTES AND NOTICES.

New Railway System.—Respected Sir, The *Mechanics' Magazine* of the 26th of December last, informs me of some remarks made by a gentleman on the subject of the great advances on the cost of railway iron, a fact which he seems to deplore. Now, sir, I do earnestly and most respectfully ask the favour of your informing that gentleman, and all Railway Companies, both past, present, and to come, that I have invented an entirely new system of railway, that may be executed at one-third, or, I do verily think, at one-fourth of the present cost, and without any risk or loss of human life, as has been the case with the Birmingham Railway. My system will admit of the work being done in a third part of the time required by the present method, and will never wear out, but, on the contrary, greatly improve by age. It is, sir, my wish to seek for a partner, or some gentleman who may feel disposed to engage with me in my invention, which may be the means of extending railways at a small expense, and render them more general all over the British empire, and also elsewhere. Your giving this an early insertion will greatly oblige, sir, yours most respectfully, J. MARCH, 122, *Houndsditch, Dec.* 29, 1835.

The Great Consols.—We have just been informed that a very valuable discovery has recently been made at the bottom of the Great Consols Mine, in the parish of Gwennap. We believe this to be the deepest point to which the globe has been penetrated by any copper-mine; and the deepest but one in the known world—namely, Monk Wearmouth Colliery, in the county of Durham. A little more than a century since, our Cornish mines were but little worked for copper, tin being the chief commodity, and the operations were confined to a few fathoms only from the surface, the drainage being effected by tackles or whims.—*Cornwall Gazette.*

"Old Gasket" censures the Editor for statements and opinions which were evidently not his own, but furnished by a correspondent, though, by an accidental omission at press, they appeared without that correspondent's signature. If O. G. will put his objections in a proper shape, we shall willingly insert them.

Communications received from Colonel Maceroni—L. B.—Clovis—Theophilus Thinskin—Mr. Weeldon.

Erratum.—In the description of Hutchison's Lever, p. 274, col. 2, line 36, for "1,100 retorts" read "400 retorts."

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price *6d.* Also, the volume complete, in boards, price *9s. 6d.*

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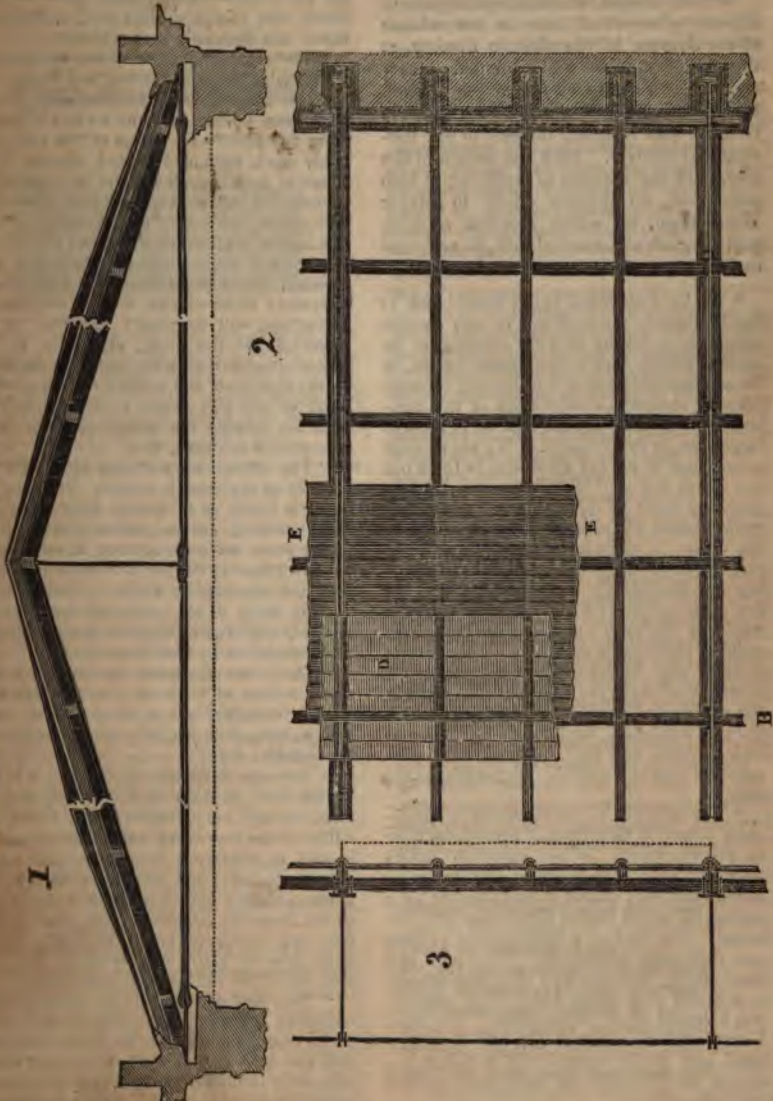


IRON-TRUSSED ROOF OF THE COSSIPORE FOUNDRY.

DESCRIPTION OF AN IRON-TRUSSED ROOF, CONSTRUCTED OVER THE BORING-ROOM OF THE NEW GUN-FOUNDRY AT COSSIPORE, BY MAJOR G. HUTCHINSON, ENGINEERS, F. R. S., SUPERINTENDENT AND DIRECTOR OF THE FOUNDRY.

We extract the following description of this remarkable roof from the last volume of the *Journal of the Asiatic Society*, at the suggestion of an esteemed correspondent, to whom we feel much obliged for directing our attention to an article fraught with so much interest to our mechanical readers. Both the design of the roof, and the manner of carrying it into execution, do infinite credit to Major Hutchinson, in whom English science, and English mechanical skill, have found in India a most fit representative:—

"We have requested Major Hutchinson, of the Engineers, the architect of this elegant structure, to favour us with drawings of its various details, that we may make known, as far as the circulation of our Journal permits, his very successful combination of the cast-iron truss with a wrought-iron tie to roofs of large span in this country. We are so little accustomed to see any thing else in India but the heavy flat roof with its massy timbers groaning under an inordinate load of terrace-work heaped up most disadvantageously in the centre to allow a slope for the water to run off, while the invisible white ant is scooping out the solidity of the timber, and the dry rot is corroding the ends that support the whole on the wall,—that the eye rests with quite a pleasurable sensation on the view of a light, airy framework like that before us, composed of materials indestructible, wherein the strains and pressures are counterpoised, the load lightened, the liability to crack and leak lessened, and the repair of every part rendered easy and entirely independent of the rest.

"The progress of improvement is notoriously slower in Government operations than in private works. When cast-iron beams were first brought to India on private speculation, and were offered to Government by a mercantile house in this town, they were rejected. The roof of a large private godown was soon after constructed with them, and their efficacy thus proved; then immediately a re-action took place, and a large quantity was indented for by Government. The Hon. Court sent them out, and they have remained until now totally unemployed, although numerous public buildings have been erected since they arrived.

"It was, we know, a subject of lengthened debate what sort of roof should be given to the foundry. A timber trussed roof had been sanctioned at 15,000 rupees, and we may, perhaps, rather attribute the substitution of the present one to the numerical reduction of the pecuniary estimate, than to any actual conviction of its superiority in other respects, for the beams being already provided, the whole cost of the present roof, exclusive of them, has been only rupees 11,000.

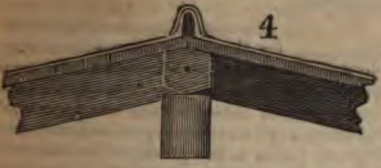
"The new foundry, or rather the room in which the cannon are turned and bored, is a spacious hall, of 169¼ feet long by 50 feet clear span in breadth, and 40 feet in height from the floor to the vertex of the roof; entirely open from end to end, lighted by a range of upper windows, and surrounded by a suite of apartments of half elevation. The steam machinery of the several borrers and lathes is arranged along one side of this room, in a compact and exceedingly neat manner. It is impossible to attempt its description; those who are fond of mechanical inventions, will be amply gratified by an inspection of the whole, especially by the ingenious contrivance for adjusting the angle of the slide rests and cutters, for the exterior bevil of the gun:—the circular revolving tools for turning the trunnions;—the crane carriage for the guns, &c.

"The self-acting principle by which the exterior of the gun is turned, while the interior is bored, so as to save one-half of the time, while it ensure perfect concentricity of the outer and inner circles, is, we believe, an invention of Major Hutchinson's, who took the opportunity when on furlough, of visiting some of the principal foundries in Europe, and studied to adopt every improvement suggested by their inspection.

"The whole apparatus is driven by two small engines of 10-horse power, which also work a circular, and a reciprocating, saw, and a loam-mill for the casting moulds of the foundry, &c.

"The superficial area of the hall is 8,462 square feet; to form an idea of this magnitude, it may be mentioned that the noble edifice of the new Town Hall in Birmingham, is said to contain a larger space than any room in Europe, and will accommodate between three and four thousand persons sitting, or ten thousand standing; that room is 140 feet long. by 65 feet broad, making a superficial area of 9,100 feet, which is only 638 feet more than the Kásípúr apartment.

"The roof consists of 10 trusses, each composed of a pair of cast-iron beams pitched at an elevation of 6 feet in the vertex, and tied together at foot by a horizontal chain supported in the centre by a vertical rod suspended from the angle. The truss-frames



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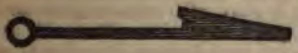

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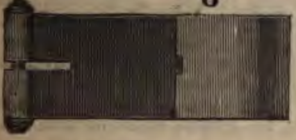

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are 15 feet 4·6 inches apart: they support light cross-beams and rafters of wood, upon which the planking of the roof is nailed. The weight of one truss with its entire load and chain is equal to about five and half tons, diffused over the two iron beams.

"The chain is 3 inches deep by 1 inch thick, $= 3$ inches in section, consequently the applicable force of tension of the chain is $3 \times 9 = 27$ tons, and the ultimate strength of it $3 \times 27 = 81$ tons. The above weight of five and half tons diffused over the two beams $= 2\frac{3}{4}$ tons on each beam, gives, according to the sine of the angle of elevation, a tension on the chains of about five and a half tons, or only one-fifth the stretching weight, or one-fifteenth of the ultimate strength of the chains.

"The iron beams and chains were all proved before they were put up, by suspending for several days without effecting the slightest apparent alteration, a weight of six tons from the vertex, producing a trial tension of about 12 tons, which is more than twice the actual tension.

"Each extremity of the tie-rods is bolted to a kind of shoe, resting upon a stone slab on the wall, into which the lower end on the iron beam abuts.

"The longitudinal tie-rods are united by a bolt, having two right-hand screws, passing through the central coupling plates of the chains, and the eye of the suspension vertex rod. This rod being firmly attached by two bolts through the beams at the vertex, any derangement whatever of the roof, either vertically or horizontally, is effectually prevented. At each end of the roof the longitudinal rods pass through the walls, to which they are firmly fixed.

"The horizontal overlaps of the copper sheathing are cemented with white lead, and the copper passes over the wooden battens fixed on the planks, to which only the copper is fastened by copper rivets; a copper cap or ridge-tile lies over the whole length, to prevent the insinuation of water at the fold: it answers this purpose so effectually, that the roof was every where found perfectly water-tight, during the late heavy season of rain, the first it had experienced.

"The Kásípur roof was set up without the assistance of any scaffolding from below. An experimental truss of timber supported on chains, having been previously made to show the advantageous application of iron chains instead of tie-beams of timber to roofs of so large a span, it was converted into a platform, moveable upon wheels along the top of the walls, upon which, by means of a crane fixed at one end of the frame, the iron beams and every thing else was easily and expeditiously raised and fixed; the beams, &c. for the opposite side of the roof being passed upon wheels across the platform. The whole framework was put up in twenty days.

"Before closing our short account of the Kásípur roof, we must notice a curious optical deception, for which we are somewhat at a loss for a correct explanation. On entering the room and looking up at the roof, it strikes every beholder that the roof has somewhat sunk, and the horizontal tie-rod is about five or six inches lower in the centre than near the walls. So firmly impressed were we of this being the case, that standing at one end of the room, and holding two flat brass rulers, overlapping one another, before the eye, we could readily measure the apparent angle of the tie-rod, by raising the ends of the rulers so as to coincide with the two halves of tie-rods. On mounting the roof and looking in at the upper window of either end, the same effect was still visible, though in a diminished degree, and we were not convinced that it was a deception, until Major Hutchinson at our request caused an actual measurement to be made by a perpendicular wooden batten from an accurately adjusted level on the stone floor. It was then proved that there did not exist a difference of level even to the amount of a tenth of an inch. Whence arises the illusion? Is it that the eye, judging of directions by comparison with other objects, and having the numerous lines of the pent roof inclined in opposite directions to each half of the horizontal rods, is thus perplexed in its estimate; the ruler experiment is opposed to such an explanation. It may, perhaps, be owing to the effect of light from the upper windows, which frequently gives a curved appearance to wooden beams from the decrease of illumination from side to centre. If the phenomenon resemble the effect of the eyes in a portrait always looking the same whencesoever viewed, or the curves formed by spokes of a wheel passing a railing, as has been suggested, the effect should admit of a rigid explanation, and we may hope to obtain it from some one of our readers who may have time to investigate this singular deception."

Description of the Engravings.

Fig. 1 is a section of the roof. Fig. 2, a plan. Fig. 3, a longitudinal section through the vertex A B of fig. 2. Fig. 4, a transverse section through B C of fig. 2. Figs. 5 and 6, section and plan of the iron shoe. D, in fig. 2, is the copper sheathing; and E E, the planks.

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STEAM-ENGINE BOILER EXPLOSIONS.

(Extract from a Letter in the *Sunderland Herald.*)

It appears to me to be particularly worthy of observation, that nearly all the explosions we have had to lament for some time past, have occurred when the engine was standing. I do not remember one misfortune taking place when the engine was going. This, together with many other circumstances, and no short experience, have convinced me that to one or other of the three following causes may be attributed nearly all the explosions of steam-boilers. If my observations should be the means of preventing, or even of lessening the number of those calamities, it will afford me the greatest satisfaction.

The first cause, then, I consider to arise from the safety-valve either being overloaded or made fast.

Second. The boiler having been suffered to become foul at the bottom. Or,

Third. A weak boiler.

As I am decidedly of opinion that by far the greatest number of these disasters have occurred from the second reason given, "a foul boiler," I will now only request your attention to that particular point.

The water with which most boilers are fed, usually contains siliceous, argillaceous, or calcarious earths, and other foreign matter suspended in it. These are gradually deposited upon the bottom of the boiler, where they form a coat or crust whenever the fire is lowered and the ebullition ceases. The first effect produced by this accumulation of matter, is to lessen the action of the fire upon the water inside the boiler, and to require more time to raise the same quantity of steam than would be necessary if the boiler bottom was clean.

The next effect is, when the engineer is raising the fire the foul coating will rise in blisters of various sizes, by which the bottom plates will become red-hot. The blisters, on their breaking, let the water down upon the hot plate, causing explosions of different degrees of violence, according to the magnitude of the blister. These explosions are similar to the report of a pistol, and take place every time the engine starts, or is preparing to start, after standing long enough for the mud to subside. They will sometimes even force down an iron plate or some parts of it, and on that particular spot where the indentation has been produced the mud accumulates thicker. In the event of these blisters being very large, on their bursting, the water will be forced into sudden contact with the red-hot iron, by which a tremendous explosion is the inevitable result. No numbar of safety-valves is an adequate security against the terrible effects of such a concussion.

To explain this material circumstance still further: if a boiler be stopped half an hour or an hour, the man generally sets the fire-doors open, and also puts a few coals on to damp the fire until the workmen are ready to commence work again. On the ebullition ceasing, the suspended matter in the boiler will nearly all subside in about ten minutes, and be deposited on the bottom of the boiler; and if the water be very foul, and the boiler bottom (or sides of some boilers) has not been cleaned for two or three weeks, it will then be a great thickness, and become thicker daily; consequently, every time the fire is raised, this accumulated mud on the bottom and sides must rise, and be completely incorporated with the water in the boiler before the steam can be raised and the machinery again set in motion.

From the foregoing remarks, an interesting question naturally arises—"Is there a remedy, or are those lamentable catastrophes still to continue to hold their desolating sway over the unsuspecting manufacturer, the industrious workman, and the distant traveller?"

Government, I see, has thought the explosions in coal-mines deserving its notice. Steam-boilers have probably caused as great a destruction of human life within the same period; and, therefore, seem equally deserving its attention. We hope the subject will be attended to by the Legislature, and every engine-man compelled to keep his boiler both clean and strong.

S. B.

Heworth, Aug. 26, 1835.

MODE OF FREEING STEAM-BOILERS FROM LIMESTONE DEPOSITS.

(From a Circular on Steam-Mills by Captain Davis Embree, of the Portsmouth (U. S.) steamer. Cincinnati, 1828.)

One great difficulty exists in steam-works, in limestone countries—the coating of boilers, valves, and pipes, by lime; all who have experienced this disadvantage, dread it. I laboured under it three years.

The supply at the Richmond steam-mill was formerly thrown into both boilers; one of the pipes was accidentally broken; the supply was afterwards thrown into one boiler, and passed to the other by a connecting-pipe. I then found the lime almost all deposited in the first boiler. It was evident from this, that simply *boiling* will render hard water soft; but still the disadvantage remained. I was at a loss to know the state of combination in which the lime existed in what is called hard water; it could not be pure lime, for in that case the water would be alkaline; it could not be a carbonate of lime, for that is insoluble, and it is the assuming of that state which produces the difficulty. On examining the notes of Parkes' "Chemical Catechism," I found it to be partly sulphate of lime, but principally *super-carbonate of lime*, which is a soluble substance. The boiling of water evaporates the superabundance of carbonic acid, which reduces it to carbonate of lime, or limestone. This is insoluble, and of course is deposited, when it adheres to metal with a tenacity which is difficult to remove, even with the sharpest instruments. I sought a remedy; I knew most of the acids must decompose it; acetous acid has a stronger affinity for lime than the carbonic acid in proportions as 19 to 12. The faints (exhausted singlings) of a distillery possess a considerable portion of this acid; I therefore used it by running the contents of the doubler, after the whiskey was off, into the cistern containing the water that was used for the engine. The effect was surprising.

A few days ago, I opened one of the boilers, which had been used five months; it was as clean as iron could possibly be with such ordinary unpolished surface, except there were a few detached cakes or lumps at the back part, which would about fill a gallon, and some specks of rust at the top of the boiler. There was no other appearance of the acid corroding the metal, although the whole products of the distillery had been used the greater part of the time. The other boiler, into which the supply was first thrown, had been cleansed oftener; it was coated with a dark-coloured scale, which I suppose to be sulphate of lime; the texture was less firm than formerly, and was perhaps one-eighth or tenth part of the *quantity which would have accumulated in the same* length of time, if the acid had not been used. This acid costs nothing; it is, therefore, the cheapest that can be employed, and it is perhaps the mildest which would answer the purpose. It being composed of condensed vapour, will again all evaporate in the boilers, without leaving any glutinous substance to adhere to them. This acid will not correct the sulphate of lime, or muddy water.

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HINTS ON HARDENING AND PROTECTING STONE, WOOD, METAL, &C., AND ON THE PRESERVATION OF PANORAMAS.

Sir,—In your 647th Number I stated that, in 1804, melted sulphur was applied to all the honeycombings on the stones, the cracks, and the interstices between the pavings of the top of St. Peter's Church at Rome, *at my suggestion*, instead of pitch, or any other cement. I have since recollected that this statement is incorrect. It was *in consequence* of my observing the excellent result of such use of melted sulphur, on the top of St. Peter's, that I induced the owners of several palaces in Rome—my relations—to adopt the same preservative: amongst others, the Palazzo Lanti; the Palazzo Maceroni, near the Farnese; that of my uncle, Falconieri, and several others: also the Convent of St. Cicilia, of which my aunt is abbess to this day. I mention these particulars, because, at that period, I was only sixteen years of age, and some might doubt the probability of my having done any such thing. Sir R. Smirke will remember that in that very year, or the year after, he adopted the recipe which I gave him for making the very best white stone cement, which became as hard and took the polish of marble. This knowledge I arrived at by carefully examining the composition of the hardest specimens of ancient and modern Roman cements and plasters, and making experiments with my own hands.

The subject which I have so often recurred to in your columns—that is, of hardening and preserving stones, cements, woods, and metals, by the application of oils, gelatines, or resins, becomes to my mind more and more important every day, in proportion as I see it utterly disregarded and neglected by those who should know how to avail themselves of such easy, simple, and natural suggestions. If any one will give himself the trouble to approach a new house or building, he will see that the quarterings and boardings which are to support the tiles or slates are carefully kept clean and free from any little bit of coal tar, or any other tar which would ensure them against rot for years and years unnumbered. The supports to the balconies are of deal, scroll-wrought, and nicely finished; but they are inserted into the brick wall as clean as the carpenter left them with his plane! To preserve them from the weather, they are painted—that is, the part projecting from the wall, which least requires it; the part inserted *in* the wall being left to rot as speedily as such a situation may promote! Palings are erected round parks, walks, and gardens; and, *after* they are put up, they are carefully coal-tarred or painted. The consequence is, that they speedily rot at the point of juxta-position with the earth! Were such constructions well coal-tarred, and were they—still better for the parts under ground—tarred and *covered with brown paper, well tarred, and fastened on with a few tacks*, their duration would be indefinite; instead of which we now see them rot—at least at the "wind and water" (or earth) line—in a very short time. Throughout the Bolognese territory in Italy, the carts, waggons, ploughs, &c., are known to last from one generation to another, as though they were absolutely incorruptible. The reason is, that all the wooden parts, as well as the felloes, spokes, and axles of the wheels are, when thoroughly dry, immersed and soaked in boiling linseed oil. I would very strongly recommend this plan to our makers of wooden wheels, as the only means of enabling them to compete with the iron ones, now being so generally and so judiciously brought into use. On another point, also, I would wish to draw the attention of your readers, to the use of preservative applications—that is, to boots and shoes. In former times, I, as well as other people, used to saturate my shooting-shoes or marsh boots with lard or tallow. These substances are but of temporary advantage; for, as soon as they become rancid, which they always do, they rot *the sewing* as well as the leather, and *produce rapid decay* and destruction. About twenty-six years ago, I thought of applying resinous substances to that purpose, and the result more than satisfied my expectations. I melted in a pipkin over the fire two ounces of bees'-wax, one of resin, one of tallow, and one of spirits of turpentine. The boots or shoes being well dried, and warmed before a good fire, are to be *saturated* with the mixture, soles and all. This composition never becomes rancid, *preserves* the sewing as well as the leather, and renders the whole waterproof. I have now in wear only three pairs of boots, which I have had three years, and I make no doubt they will last me five years longer. For those who are ambitious of a fine polish to their boots, I beg to state that one ounce of bees'-wax dissolved in five or six ounces of spirits of turpentine, being applied as the last operation, or some days after the other above described, will cause them to shine like a mirror. This wax and turpentine solution may be used alone, for ladies' and children's shoes and boots, with great benefit and brilliancy. If any perfect and easy solution of India rubber (caoutchouc) could be readily made, it might be preferable to any such things as I recommend; but *I know of none* which has not defects and objections. A shoemaker of Green-street, Leicester-square, however, makes boots and shoes of canvas, linen, &c., saturated with India rubber, which appear to me entirely to meet the object of the invention.

Another word, just as it occurs to me on the subject of providing for and guiding the national taste, in the matters of design, the imitation of nature, and drawing in general. The point I only mean to mention is that of panoramas, or rather of their lamentable and premature destruction, so soon as they have been exhibited for lucre, during a given period to *the public*. During these fifteen years past, I have addressed several letters to the "*Examiner* and to the *Chronicle* on this subject, without eliciting any attention. But—

> "*Chi lava la test' all' asino spreg' il sapone;*
> *Chi predica al deserto perde' il sermone.*"

The point to which I have in vain been so anxious to draw attention on the subject of panoramas is, their preservation for an unlimited period, as useful, instructive, and pleasing monuments of art, for the gratuitous contemplation of the public. Which of us has not been delighted and instructed by Mr. Burford's views of Naples, of Elba, Mexico, Malta, Palermo, Edinburgh, Quebec, Jerusalem, Pompeii, Niagara, and a hundred other most interesting exhibitions of cities and localities, besides those of battles and scenes of an important historical character, such as Trafalgar, of Paris, Vittoria, Aboukir, Navarino, and a hundred other pictorial reminiscences, which are at the same time most excellent works of art. But no sooner is the narrow circle of metropolitan curiosity partially satisfied, than the labours of months, and perhaps of years, is destroyed; the whole is consigned to the whitewashing brush, and another production of eminent genius is erected on the grave of its predecessor!

Now, from inquiries I have made, this painful destruction and burial is perpetrated *merely for the sake of the canvas!* That the quantity of square feet of canvas required for a panoramic picture is very great, there is no doubt; and also that it requires a building of a particular construction to give effect and truth to the light, perspective, &c. But are there not thousands of wealthy individuals in this country, besides corporations, societies, and unions, who might easily erect a proper recipient of old timber and planks (well coal-tarred), and who, after the fashion of Aladdin, by merely giving new canvas for old, to the Burfords, &c., might secure to themselves and to posterity the contemplation of objects whose interest would endure to the latest generations?

I have often thought, if I were the possessor of a park and plenty of timber and money, and but a grain of sense and feeling, how I should delight in setting up these discarded panoramas in certain parts of my premises. The Bay of Naples for a dining-room; the Falls of Niagara in one corner of the domain; the battle at which I had, perhaps, been present in another; eat maccaroni in the midst of the ruins and pictured walls of Pompeii; quaff Falernian wine, surrounded by a view of Baja, Puzzoli, and the Elysian Fields, where it grows; *or descant on* the volcanic phenomena, with an eruption of Vesuvius or Etna, before our eyes. But, alas! these are dreams of by-gone happiness—so to the *useful* again, and to the acquisition of such things for the purpose of *instruction*. How many towns, districts, corporations, might not extend the knowledge, the taste, and the love of art, by setting up these excellent productions of art in their respective districts, at a trivial expense and permanent benefit! Were the back of the canvas to be protected with coal-tar, or any resinous solution, it would last nearly for ever.

I am, Sir, your obedient servant,

F. MACERONI.

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GAS-VALVES.

Mr. Editor,—Your Magazine of the 21st of November contains a description of a new gas-valve, by A. Y. of Nottingham. It appears to me that your correspondent has overrated the value of "The Nottingham Hydraulic Gas-Valve." Instead of possessing the advantages he has ascribed to it, it is, on the contrary, extremely deficient in those qualities which are considered absolutely indispensable in a machine of this description. I am greatly in error if the majority of the London gas engineers would not at first sight perceive its defects, even if submitted to their inspection.

I would observe that, instead of the addition of an hydraulic cup being an improvement, it is rather an objection. If Mr. Carter (who is, I believe, the inventor), or A. Y. will give the subject one minute's consideration, they will perceive that it is liable to two very material accidents, the occurrence of either of which would instantly involve the town of Nottingham in darkness—namely, that the water would be diminished by evaporation, or unduly augmented by that condensation which takes place during the passage of the gas through the valve. It must be evident that the occurrence of either of these circumstances would effectually prevent the free progress of the gas into the street mains; the consequence of which would be an immediate counteraction, which would seriously affect the purifiers, condensers, and ultimately the retorts.

A. Y. must be aware that a gas-valve ought to be completely under the control of the engineer, or individual who superintends the regulating of the supply. I would, therefore, ask, how is this person to ascertain whether there is a sufficient quantity or a deficiency of water in the cup?

The Nottingham valve is merely an adaptation of a well-known principle that has been in practice for many years, and may be seen in operation upon the wet-lime purifiers at the London gas-works at Vauxhall. I regret to say that even the very best valves at present in use are imperfect; they do not in every respect effectually answer the purpose for which they are intended, and their deficiency is often a serious hindrance to gas-manufacturers.

CLOVIS.

MATERIALS FOR A NEW EPISTLE TO THE PHILIPPIANS.[*]

Sir,—In slightly glancing over a work lately published by Sir Richard Phillips, entitled *A Million of Facts*, from which I anticipated that I should be enabled to furnish the Royal Astronomical Societies of London, &c. with the correct distances of all the planets from the sun; together with their densities and attractive powers, &c.; the diameter of the solar orbit, and, in fact, the exact value of every perturbation in the planetary motions; so that we might have had our astronomical tables computed from co-efficients obtained from the above data, and stereotyped; as no *addenda* or *corrigenda* would then have been required. And all this without the unavoidable delay in waiting the transit of Venus in 1874, and the attendant expenses of sending observers to St. Helena, the Cape of Good Hope, Spitzbergen, New South Shetland, Hudson's Bay, the South and North Poles, and, perhaps, some ten or a dozen other places equally distant; not to say any thing about the expenses attached to astronomical observatories, and the many sleepless nights experienced by astronomers, which, in the above case, might have been dispensed with. Now, Mr. Editor, judge of my mortification and disappointment—I, who expected nothing less in such a case than to have been made an Honorary Member of the Royal Astronomical Society of London, and to have had my name enrolled at the very tip-top of the list of benefactors to the sublime science of astronomy—I say, judge of my disappointment when on the investigation of the formulas contained in the said work, I discovered what?—why, that it was all *fudge*;—my fame, unfortunately, was not supported on pillars of iron, brass, or stone, but on pillars of ice; for no sooner did the warmth of my imagination begin to irradiate, than the icy pillars melted away like icicles in the meridian sun, and left my fame prostrate in the dust!

Now, sir, instead of my addressing the astronomical societies on the above subject, it only remains for me to solicit your insertion of this affair in the *Mechanics' Magazine*, as a warning lest some other luckless wight should experience a similar disaster. *Now for gravity.*

Sir Richard has taken an infinite deal of pains in order to promulgate his theory of the planetary motions in opposition to the Newtonian. It will not, perhaps, be deemed presumptuous to give an estimate of the value that ought to be attached to the formulas constituting this new theory. Sir Richard has given his process for finding the earth's distance from the sun at full length (col. 293, 1st edit.), as follows; viz. "This distance of the sun from the earth taking a degree at 69·148 miles at the equator, is computed as under by the theory of motion, *i. e.* orbit = rotation × 4 × fall of bodies!![†]"

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[*] We recognise with pleasure the hand of an old friend and correspondent in this communication; but we are half inclined to think he has in this instance employed his talents on a work of supererogation. We have never heard (and certainly never suspected) that there was any second person in the world who subscribed to the Anti-Newtonian *absurdities of* Sir Richard Phillips.—ED. *M. M.*

[†] This new theory of Sir Richard's is founded on the above conditions; viz., that the orbicular motion is equal to four times the rotary motion multiplied by the fall of bodies in one second of time.—(Vide col. 2.)—The orbicular motions of the planets decrease the farther they are situated from the sun, whilst the magnitudes and rotary motions follow no regular law. The greater the diameter of a planet, the greater will be its rotary motion, attractive power, and, consequently, fall per second, which occasioned the egregious blunders I am going to point out, resulting from Sir Richard's formulas.

Log. of deg. in 365,101 feet	5·562412
× 360	2·556303
131,455,000 feet, or 7,924 miles diam.	8·118715
86,163″ in a day	4·935320
1525·4 feet per second	3·183395
× 4 for sphere	·602060
6101·6 central force	3·785455
× fall per sec. 16·08728 feet	1·206493
98,163 feet in orbit per sec.	4·991948
× seconds in a year	7·497960
Feet in orbit	12·489908
÷ 6·283, &c.	·798180
Feet in distance	11·691728
÷ 5,280 feet in 1 mile	3·722630
Log. distance	7·969098 = 93,131,800 miles estimated

by the ascertained fall of a body in a second.—(Vide *Million of Facts*, col. 293.) The above result may, however, be obtained with one-fourth part of the labour as follows:—Let d denote the diameter of the planet, v the velocity acquired at the end of the first second of time, and r the number of rotations in a siderial year. Whence the distance, as above, is equal to $d \times v \times r$.

Example:—

d = 7924 miles — Log. = 3·898945
v = 32·09 feet vel. acquired 1·506368
r 366·2564 sid. days . . . 2·563785

Log. dist. = 7·969098 = 93,131,800 miles the distance as before.

Example for the Planet Jupiter:—

d 86,400 miles . . Log. 4·936514
v 15 feet vel. acquired — 1·176091
r 10470·92 sid. days — 4·019985

Log. dist. 10·132590 = 13,570 millions of miles,

being upwards of 27 times the true distance of Jupiter from the Sun!

Example for the Planet Saturn:—

d 78,000 miles . . Log. 4·892095
v 6 feet vel. acquired — ·778151
r 25135·72 sid. days — 4·400291

Log. dist. 10·070537 = 11,763½ millions of miles,

or upwards of 13 times the true distance of Saturn from the Sun! We now arrive at a *sublime discovery, for, lo!* and behold! Saturn is 1806½ millions of miles nearer to *the Sun than the planet Jupiter!!*

In col. 615, in the *Application to Facts*, we are told that if the orbicular motion be divided by 4 times the rotary motion, the quotient will be equal to the fall per second at the earth's surface. Now, if this process be applied to the planets Jupiter and Saturn, it completely fails, as the fall per second comes out *negative*. The rotary motion of the planet Saturn exceeds his orbicular motion; and, consequently, all bodies situated on the equatorial regions of Jupiter and Saturn must have a tendency to gravitate upwards, instead of gravitating towards these planets. This is what I should call gravity bewitched!!!

In the Addenda and Corrigenda (col. 697) is given a statement of the distances of the planets from the sun; the distance of Uranus is nearly 238 millions of miles nearer the sun than the distance as given in col. 311, both of which are computed from Sir Richard's formulas, or what he styles his new law. There is also a considerable difference in the distances of some of the other planets, which are not in accordance with the analogy which I discovered some few years since, viz. that the square of a planet's orbicular motion, multiplied by its mean distance from the sun, is a constant quantity for all the planets. The same law obtains in each respective system of satellites; a different result is, however, obtained for each system proportional to the sun's attractive power compared with each primary planet, for if the square of the satellites' orbicular motions be multiplied by their mean distance from their primary, and this result be multiplied by the reciprocal of the attractive power of the sun and the primary planet belonging to each system of satellites, the same constant quantity will be obtained as that for the planets above stated. Thus, then, a universal balance or equilibrium obtains in the motions of the planets, and their respective systems of satellites, which a *million million* of such *Facts* as Sir Richard's will not be able to derange.

Now, after all this blundering, we trust we shall hear no more from Sir Richard about the absurdity and superstition of LAPLACE; *or about the gross quackery, errors, fanciful theories, and profound nonsense of* SIR ISAAC NEWTON!!!

I am, Sir, yours, &c.

J. UTTING,
Civil Engineer and Surveyor.

Lynn Regis, Jan. 16, 1836.

P. S.—In order to assimilate the conditions of the formulas of Sir Richard to the other planets, it was necessary to divide their periods of rotation into hours, minutes, and seconds, similar to the division of time on the earth's surface; hence 1 hour on the earth is equal to 2h. 24m. 36s. of time on the planet Jupiter, or = 2h. 19m. 48s. on the planet Saturn. Consequently, the velocity acquired for 1 second of such time for the above planets is between $\frac{1}{5}$th and $\frac{1}{6}$th part only of what it would be for a second of our time, being proportional to the square of the reciprocal of their periods of rotation to unity; whence ♃ = 15 042, and Saturn = 5 994 feet. In the 3d edit. of *Facts*, Sir Richard has introduced into his formula, as the prime ingredient, the 1·5 power of the distances and orbicular motions of the planets, and gives a *constant* = log. 10·588597 for the earth and every planet. If Sir Richard will refer to the 62d vol. of the *Philosophical Magazine* (should he not have done so previously) he will there find that I gave a *constant quantity for all the planets and satellites in the solar system*; and in the 8th volume of the *Mechanics' Magazine*, p. 29, he will find that I there made use of the 1·5 power. These were published years before the 1st edit. of the *Facts* were printed.

N. B.—The *crowning propositions* in illustration of the mechanical principles of physical philosophy and astronomy, as rigorously deduced by Sir Richard Phillips in 1834, will be commented on hereafter.

PARLIAMENTARY EVIDENCE ON ACCIDENTS IN MINES.

(Continued from p. 304.)

Examination of Mr. Nicholas Wood, continued:

May Killingworth colliery be considered a fair specimen of a fiery mine in Northumberland, neither exceedingly explosive nor liable to very partial eruptions of gas?—In working the whole mine of Killingworth, I should take it to be rather above the medium of danger; in the pillar-working it is a safe colliery, so far as the average quantity of pillars have been worked, but, on the whole, I should take it to be about the average.

Will you endeavour to form an idea, to the best of your recollection, or from any particulars in your possession, of what the average loss of life has been, as a per centage upon 500 men, in the space of fifteen years?—I cannot state precisely the number that have lost their lives by explosion within that period, but I think it does not amount to more than eight or ten in the whole period; I think not more than ten.

Have many others received grievous wounds and injuries?—We have had a great number of small fires, such as I have described in the bords in the whole coal-workings, which have hurt men, but they have almost always recovered; but I cannot state to what extent that may have been. I myself was burnt on one occasion along with three or four more, but it was slight.

Do you think that information, or the love of reading and scientific research, is on the increase in the mining districts of the north of England?—I think the love of reading is on the increase; I think the overmen, and those men also who have charge of the different departments, are more intelligent than they were when I first knew the trade.

Do you think that moral character generally, and that the moral habits of the mining population in the north, is improving or otherwise?—I am afraid there is no great improvement in that respect, except in the rising generation.

What proportion of the pitmen are able to read?—I should say a very inconsiderable proportion of the grown-up pitmen can read.

In signing the pit-bonds, is it not the case that perhaps there is not one in fifty that can sign otherwise than by a mark?—They always sign by a mark; they refuse to write, even if they can.

From the age that the labour of boys begins to be profitable in the colliery districts, is there any more chance of parents sending them to school between the ages of eight and twelve than subsequently?—I think in most of the collieries there are schools patronised by the owners of the collieries, and the boys have an opportunity of attending schools at nights, and also when the pits are off work. The pits are not worked more than eleven days, and very often a fewer number of days, in a fortnight, and they then have the opportunity when the pits are off work of attending schools.

Do they, in fact, make use of that opportunity, and go to schools when the pits are not at work?—At nights they do, I think; it is not so much practised in days when they are off work.

Is it the case that the rising race of pitmen are likely to be better instructed, by the care of their employers, than the last race were?—I think the pitmen, generally, are more intelligent than they were; but their habits are, not to acquire much knowledge about what is going on in the pits; they exhibit a sort of *indifference* in that *respect.*

Mr. George Johnson, Coal-Viewer, examined:

Agrees generally with Mr. Wood. Manages the Wilmington colliery, which gives out a large quantity of inflammable gas, and in which an explosion occurred in September, 1831.

Was the loss of life considerable?—There were four men and four boys killed, and seven were severely scorched; but I ought to state that this accident was not caused by the state of ventilation in the seam in which we were working, but from a blower met with in a Bensham seam, 38 fathoms below the high main coal. This Bensham seam had been arrived at by a staple sunk at some distance from the main shaft; a considerable blower was met with, which we were necessarily obliged to bring into the main air-course in the upper seam. A violent eruption of this gas came off, met with the candles of the workmen in the upper seam, and caused an explosion.

Had you any warning of such a contingency?—The emission of gas was great before that period; I got alarmed, and I allowed the workings in the Bensham seam, which were very limited, to fill up with water, conceiving they would fill up gradually, and then by that means the whole space in the Bensham seam would be filled with water.

The water did appear to fill the seam, and rose up the staple 13 fathoms, but the gas had been so powerful as still to leave a considerable space, I conceive, near to the orifice of the blower.

The idea never suggested itself to you that a pent-up magazine might be formed in the Bensham seam?—I conceived that the water having fallen into this seam would have filled up all the working places; but so far from that, the strength of the gas, I think, kept the water back from the blower, and it increased in strength and magnitude till it forced its way through the water into the upper seam.

Do you consider that there is still a gaseous communication between the Bensham seam and the upper seam?—After the accident, I thought it was necessary to shut up the Bensham seam entirely, therefore I closed the staple up by putting a strong cap of iron over it, into which I introduced a 3-inch iron pipe, and by that means bring the gas to the surface, where it is burnt.

Do you mean to say that there is still a constant rush of inflammable gas from the Bensham seam, through this pipe which you have mentioned, to the surface of the earth?—Constantly.

Do you ignite that?—We burn it every night.

Do you burn it to get rid of it, or to illuminate the works?—It illuminates part of the works at the pit-heap on the surface.

What is the height of the flame constantly emitted?—Generally about a yard high.

This light, of course, can be seen from all the neighbouring country?—From a considerable distance.

Does it burn with a bright yellow flame?—With a bright flame, except where it first issues out of small apertures of the *burner;* it is then very blue; after being mixed with atmospheric air it burns with a bright flame.

Do you consider that there is still a decided pressure on the gas from the Bensham seam from the presence of water, or is it nothing more than the natural pressure of the superincumbent strata?—This gas being a lighter body than atmospheric air, ascends up this pipe with great rapidity; there is still a considerable supply of gas from this blower.

Have you made any calculation as to the number of cubic feet which is emitted in any given time from this aperture?—I have not.

But this experiment shows that, independent of what is emitted in the course of working the mine, there is a very large exhalation from the coal not in a state of working?—Yes, there is.

Mr. George Stephenson, C. E., examined:

Previously to becoming a civil engineer, was very much engaged in erecting steam-engines for coal mines in the north of England and inclined planes for bringing the coals from the mines to the mouth of the shafts. Was in 1809 at Killingworth, which is a very fiery mine, when an explosion took place, by which ten lives were lost.

Will you describe the appearances at the time?—The pit had just ceased drawing coals, and nearly all the men had got out; it was some time in the afternoon, a little after midday; there were five men that went down the pit, four of them for the purpose of preparing a place for the furnace, the fifth was a person that went down to set them to work; this man had just got down to the bottom of the shaft about two or three minutes when the explosion took place; I sent the man down myself. I had left the mouth of the pit, and gone about fifty or sixty yards away, when I heard a tremendous noise, looked round, and saw the discharge come out of the pit mouth like the discharge of a cannon; it continued to blow, I think, for a quarter of an hour, discharging every thing that had come into the current; there was wood came up, stones came up, and trusses of hay, that went up into the air like balloons; those trusses had been sent down during the day, and I think *the trusses had in* some measure injured the *ventilation. The ground* all round the top of the pit was in a trembling state; I went as near as I durst go, and every thing appeared cracking and rending about me; part of the brattice, which was very strong, was blown away at the bottom of the pits; very large pumps were lifted from their places, so that the engine could not work. The pit was divided into four by partitions; it was a large pit fourteen feet diameter, and partitions put down at right angles which formed four. The explosion took place in one of those four quarters, but it broke through into all the others at the bottom, and the brattice or partition were set on fire at the first explosion. After it had continued to blow for a quarter of an hour, as I have stated, the discharge ceased, and the atmosphere all round poured into the pit to fill up the vacant place that must have been formerly occupied by the flame. In one of the other pits, that was connected with this one in which the explosion took place by some doors in a drift leading from one pit to the other, several men, who were in the adjoining pit, were not reached by the explosion, and several of them got up safe. The ropes in the first shaft were shattered to pieces by the force of the blasts, but the ropes in the other pits were still left uninjured, at least they were very little injured. Nobody durst go near the shafts, for fear of another explosion taking place, for some time; at last we considered it necessary to run the rope backwards and forwards, and give the miners, if there were any at the bottom of the shaft, an opportunity of catching the rope as it came to the bottom; whenever the rope went to the bottom it was allowed to remain a short time till we considered they had time to cling to it; several men were got up in this way; and another man had got hold of the rope, and was drawn away, when an explosion took place at the time he was in the shaft, but it was merely like the discharge of a gun, and it did not continue like the former blast. This man it appeared had been helped up so far with the increased current that came about him, and the rope running up at a great velocity, the man came up without being injured; it was a singular case.

Did the sides of the pit fall in?—No, they were obliged to fill it up with water, to put out the fire.

It continued exploding?—Yes. It appears that the coal had taken fire, and as soon as the carburetted hydrogen gas collected in sufficient quantity to reach the part where it was burning, it ignited again; but none of the explosions were equal to the first, on account of many parts of the mine having been filled with azotic gas, or the after-damp of the mine.

What lapse of time took place before any of the viewers or managers of the colliery were able to explore the extent of the damage occasioned by this explosion?—It was twenty-three or twenty-four weeks before they got to the bottom of the shaft, which was so shattered that it required to be repaired, and the atmospheric air to be carried down.

Were there no means of access from any of the other shafts?—There were none; the other shafts became in the same state very soon.

Then the bodies of the sufferers were not recovered for the space of time that you have named?—They were not. All the ditches in the "country-side" were stopped to get water to pour into the pit. We had extinguishing or fire-engines brought from Newcastle, and the water was poured in till it came above the fire, and then it was extinguished.

This accident was of course attended with severe pecuniary loss to the owners of that colliery, in addition to the destruction of human life?—It was.

At the period of this accident candles only were used. Witness then thought of contriving a lamp (enclosed light) which could be taken into an explosive mixture without exploding externally. His idea was, to produce a strong current through a lamp by means of tubes. The first he made had a tube at the bottom to admit the atmospheric air, or fire-damp and air, to feed the burner or combustion of the lamp, and a chimney at the top to assist the current. This lamp was tried in the mine on the 21st of October, 1815, and it always went out when exposed to a blower of gas; but the lamp required to be carried very steadily on account, as the witness imagined, of the burnt air (as he then called it), or the azotic gas, that lodged round the exterior of the flame. When the lamp was moved backwards and forwards, this poisonous air came in contact with the flame and put it out. It then struck witness that if he put more tubes in he should discharge the poisonous matter that hung about the flame, by admitting the air to the exterior part of the flame. He, therefore, got a lamp made with three tubes, of a diameter considerably less; and this was tried in the mine, November 4, 1815. Found that it would burn much better than the other; but the result was the same as with the first lamp when it was brought into contact with a blower of gas. These new tubes pointing towards the flame, whenever the inflammable gas came to the point of explosion in the lamp, it ran back to the tubes, but did not go down them, but simply ran from the burner to the tubes, burnt for a short time, and then went out. This proved to witness that the tubes did not require to be so long, because the gas did not actually go into them at all. His next lamp had, therefore, a double perforated plate at the bottom, with the holes considerably smaller. Still did not know of what size the holes should be, but made them very small. This lamp was tried immediately after November 4, and found to burn extremely well. The principle of the lamp now before the Committee is now precisely the same, though the shape is rather different. It was tried at the Philosophical Society in Newcastle, and certainly before any other lamp had made its appearance. At this time witness had had no access to any scientific works, nor any intercourse with scientific men. Is still more convinced than ever that his lamp, properly constructed, is the safest lamp that could be made use of. So long as the glass keeps whole it never can fill with flame; and though he has seen the glass crack, never knew it fall to pieces in the lamp, as it only cracks to ease the expansion or contraction, and remains safe.

But you do not mean to say that your original lamp of unprotected glass would be equally safe with No. 5, now produced—do you?—No, I mean with the wire-gauze out-side that it is certainly the safest lamp.

Considers the system of ventilation followed in mines to be very faulty, but does not yet see how it may be remedied. Is not prepared to recommend any better mode than the use of the furnace. But thinks that there might be some instruments kept in the mines to serve as a continual guide to the miner when he goes down. Believes it very rarely happens that accidents have taken place to any great extent but only at the time when the barometer stood low. Now if a good large barometer were kept at the bottom of each mine, which the overlooker, the wasteman, or those that have any charge, should have an opportunity of seeing it, would put him on his guard in some measure to look out for danger. Has made some experiments himself on blowers to prove how this would act. Has gone down when the barometer stood very low; and found some of the blowers or fissures throwing out very great quantities of gas. Has gone again when the barometer has stood high, and the very same blowers that were sending out the quantity of gas when the barometer stood low, was taking in the atmosphere, so that there was not near the quantity of gas. In fact, it is not possible that the quantity of gas can come out when the barometer stands high that does when it stands low, because the atmosphere is varied in its pressure considerably.

Do you think that the small difference of density indicated by 14 lbs. an inch and 15 lbs. an inch, would be sufficient to cause diminution or increase of the carburetted hydrogen from the fissure?—I think in one case a very large quantity of gas might come out, and in the other very little might come out; indeed I know that it is the case.

Then the great advantage which you would anticipate from the use of the tube barometer always in sight of the underviewers and wastemen, would be to stimulate them to an increase of care under certain changes?—I think so. I used to give my instructions to the wastemen in Killingworth upon that very point, and many got barometers from my observations to them.

Are you aware whether they have continued to make observations?—I dare say they do, but I cannot speak to that, not having been among them lately.

Are you aware whether their experience in any way corroborated you?—Yes, I am sure that some of them did; I was so familiar with them, and talked to them about it, and we know that such a change took place.

They acknowledged that the mine was in a fouler state whenever the barometer indicated a diminished pressure of atmosphere?—Yes, and it was a common observation of the wastemen, that the explosion was caused by the south wind, which occasioned this state of the barometer; before they knew any thing of the barometer, that was the observation that they made.

In many mines is it not the case that the hewers on turning out and finding a warm south-west wind, decline proceeding to work?—I believe it has been so.

Witness is aware that the electric spark will cause explosions of different mixtures of atmospheric air and light carburetted hydrogen, but does not think explosions in coal mines can ever have arisen from this cause.

You think that the electric spark is never given out below the surface of the earth in sufficient quantity to produce combustion?—I think there is not the slightest possibility of that, on account of the moist atmosphere, which will not hold the electric spark; it is conducted always down into solids.

Are you not aware that the electric spark has been seen to ascend from the surface of the earth?—I do not see the possibility of it.

Is it not so stated?—I cannot say the earth becomes positively charged, and the air or cloud becomes negatively charged,—it may be so.

Do you think all the accidents in lighting are caused by the descent of the fluid?—Yes, probably never the reverse.

Did you ever read this passage? "I found that the common electric spark would not explode five parts of air and one of firedamp, though it exploded six parts of air and one of damp."—Yes, I can easily conceive that such an experiment can be made, but it was by artificial means, it would be by an electrical machine or from a galvanic battery, getting the spark artificially.

Do you consider that that was his opinion on reading further, "But very strong sparks on the discharge of a Leyden jar seemed to have the same power of exploding different mixtures of gas as the flame of a taper." Do you think the descent of the electric fluid into the earth is at all times perceptible?—No, I do not imagine that he is referring there to any discharge of the electric fluid from the atmosphere, but in the Leyden jar, it was then obtained from the electrical machine.

Do you think it never exists in the atmosphere in as concentrated a state as in a galvanic battery?—I think it cannot be, I have tried to collect it with copper wires on a very large scale; I have had 500 yards of copper wire sent up by a kite for the purpose. No electricity could be obtained in damp weather. In the middle of the winter it could always be collected in the greatest quantities, and of such intensity that we could electrify any thing by the wire merely from the kite.

Do you mean to say that the discharge that throws down a house is not equal to the discharge from a common battery?—Far more so; you might make the battery equal to any thing by increasing the size, but when a house is thrown down, that is a current of electric fluid thrown out of the atmosphere.

Do you consider that such a current would not cause explosion if it came upon a magazine of inflammable gas?—I think it might by descending in that way, if that were possible.

Do you think it quite impossible that such a portion may remain to ignite that magazine below the surface of the earth?—I do.

On what ground do you give that answer?—As soon as ever it reaches the earth it immediately becomes eased by the immense mass that takes it in. I will take a tree that is struck by lightning: the tree is sometimes shattered to pieces, but you do not see the ground disturbed at all, yet the fluid goes into the ground.

Do you consider that the tree, although a conductor, offers any resistance to the passage of the electric fluid, as compared with the atmosphere?—I think it does; when it catches the points of a tree it immediately seizes the tree with great rapidity; while it is acting upon the branches it very rarely disturbs the branches, from the immense space occupied by them, but when once brought into the trunk it is frequently shivered to pieces, from the small space it has to pass in.

If conductors on the surface of the earth operate so as to radiate the electric fluid, do you conceive it impossible, that by certain metallic earths it may again be concentrated and conveyed to a magazine of inflammable gas?—Perhaps so.

Do you mean to say that the electric spark cannot be conveyed by conductors into the earth?—I mean to say that it can, and it is; but not in quantities.

Mr. George Upton, Lamp Manufacturer, Cheapside, examined:

Has paid great attention to the subject of the safe lighting of mines. Was induced to go particularly into the examination of it from having been told by his partner, Mr. Roberts, who had been a working miner for twenty-five years, that the Davy-lamp was not safe. After two or three years experimenting, in conjunction with Mr. Roberts, produced a lamp which is wholly free from the defects of the Davy-lamp.

Will you describe to the Committee in what respect that lamp varied from Sir Humphrey Davy's?—The lamp of Sir Humphrey Davy's which is in general use, fills with flame immediately it is placed in an inflammable atmosphere; it receives the air through the meshes of the wire-gauze from the point of the wick to the top of the cage, as it may be required. In our lamp, which I will now produce [*the Witness produced the same*], the air passes between a layer of wire-gauze and a cone before it can pass from the wick; the cone brings the whole air admitted into the lamp in immediate contact with the flame, or as nearly the whole of it as possible. The consequence is, that the air that passes from the wick has been rendered incapable of supporting flame by that contact, and consequently no other part of the lamp but at or near the wick is capable of supporting combustion; the advantage of which is, that the flame never comes in contact with the wire-gauze. It has not power, therefore, to act with force upon the top of the wire-gauze, which is most powerfully acted upon in Sir Humphrey Davy's lamp; the top is the most vulnerable part of his lamp. I should name that in our lamp a glass is put over the wire-gauze cage to drive the air under the horizontal layer of gauze below the wick, otherwise it would not pass that way.

How is the air forced down?—It is drawn through certain protected holes by the flame of the wick, the access of air being prevented in all other parts of the lamp by the glass covering. If it were not for the glass, the air would go the readiest way, and pass through the gauze cage as it does in Sir Humphrey Davy's lamp.

How is the air prevented from going through now?—By the glass covering before stated; the current of air passes out of the top of the lamp.

And you contract the upper orifice not more than to permit the exit of the air that is necessary?—The lamp wants it sufficiently large to keep up the supply of fresh air; because, if the burnt air were not let out of the glass chamber sufficiently quick to admit fresh air, it would destroy the combustion at the wick.

(*To be continued.*)

MR. HERAPATH AND HIS RAILWAY THEOREMS.

Sir,—The correspondent who figures in your last Number as "A Looker-on" puts one in mind of one of the finny tribe (*ordo salmonis*) who, when hunted to death by torch-light, pokes its head under some convenient bank, in the vain hope that nobody will be able to recognise it by its tail. Who so stupid as not to be able to assign at once to this "Looker-on" his real name and surname? *Aut Diabolus, aut Herapathius.* Close pursued by that brave old Highlander, Iver M'Iver, with spear in one hand and lighted brand in the other—driven out of one hole after another—chased from one side to the other, down stream, up stream—pricked and bleeding in a hundred places—the fish (a queer one, it must be confessed) has taken, in despair, to the bank at last, thrust its nose in the mud, and turned its tail on the foe! To drop metaphor, Mr. Editor, who but Mr. John Herapath himself would have ventured to say ("an act of justice" he calls it!) that "Mr. Herapath has the merit of having given *the first* direct solution to the problem of finding the relative velocities of a locomotive-engine carrying different loads on a plane and up different inclines" (which solution is just no solution at all)? Or who but Mr. John Herapath himself could have gone the greater length (still in all modesty) that "no *other* mathematician COULD have directly solved the problem?" (!!!) Who, again, except Mr. John Herapath himself, would have ever dreamt of talking of the said Mr. John Herapath's "own physical discoveries," seeing that though the world has heard much about such discoveries (from Mr. Herapath himself, as usual), the world has yet to learn what single thing of the least consequence Mr. John Herapath has discovered? Or who but a controversialist of Mr. Herapath's surpassing candour and ingenuousness, would have ascribed (as "Looker-on" has done) to Iver M'Iver a theorem for railway velocities which Iver M'Iver never promulgated? Twice in the course of this discussion has Iver M'Iver distinctly warned your readers, that the true theorem (*his* theorem, at least) still remained to be given; and it is impossible for Mr. Herapath, or any one, to tell as yet what that theorem may be.

Apropos de bottes.—On the 5th Dec. last a certain "Philo-Anti H." (so wondrously resembling our present "Looker-on," that one might safely swear they are *alter et idem*), challenged all the world "to point out in the thirteen letters of Railways, *within a fortnight*, the cases of intentional and prejudicial misrepresentation on the part of Mr. Herapath," and pledged himself "*within another fortnight* to answer the charges," and exhibit H. and his aspersions in their true colours." Within less than a fortnight after this bold challenge, that is to say, in the next following Number of your publication, "Miso-Philo-Anti-H." pointed out certain pages in the *Mechanics' Magazine* (No. 641, p. 133, and 134, and No. 642, p. 167 and 168), where Philo-Anti-H. (or Mr. Herapath), would find charges touching the Greenwich Railway of as broad and definite a character to refute as any person could desire to grapple with. But though far more than the "other fortnight" has elapsed, within which the challenger pledged himself to give his answer, no such answer has yet appeared; nor, I presume, been received.* How, sir, are we to account for this? What else can we infer from the silence of the challenger than that he *cannot* (on *further* consideration) refute "the broad and definite" charges brought against him?

As H. has silenced Mr. Herapath on the subject of the Greenwich Railway, so I venture to prophecy will Iver M'Iver silence him ere long on the subject of his locomotive theorems (about which it will assuredly be found in the end, "the less said the better").

One word before I conclude, by way of grave and (taken as it may be) kindly-meant advice to Mr. Herapath:—If he wishes to sustain (were it not that I might be thought offensive, I should say *improve*,) the scientific reputation he has acquired, let him in future think *a little* before he writes—think less of himself, and more of others—(for it were unjust to nature to suppose that all genius and wisdom are centred in one individual)—look upon the cause of truth as something even dearer than self-glorification—eschew all paltry shifts and still paltrier disguises, when proved to be in error—(as even the best of frail mortals may occasionally be)- and be ever as ready in his own proper person to pay to reason the homage of a willing submission, as to share personally in her triumphs.

I have the honour to be, Sir,

Your most obedient servant,

F. M. MEREDITH.

Cambridge, Jan. 19, 1836.

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* Not received certainly.—ED. M. M.

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NOTES AND NOTICES.

The Comet.—M. J. Muller, assistant in the Observatory here, again saw Halley's comet on the night of the 31st of December. It was very faint indeed, but precisely in accordance with the calculation of Professor Gautier, Director of the Observatory. M. Muller directed his telescope at the minute given to the spot designated, and saw the comet really appear, and pass across the object-glass. This was on the 31st of December, at night, at 12h. 45m. 15 1-7sec. astronomical time; or 5h. 56m, January 1. civil time; right ascension, 16.18½.; and south ascension, 24.44.—*Geneva*, Jan. 4.

Chimney Cowl.—"In your 640th Number there is a cowl stated to be invented by "an ingenious friend" of Mr. L. H. Mundy. If Mr. Mundy will refer to your 2nd vol., August 7, 1824, he will, I think, find that he has been forestalled. It is there stated to have been copied from a French frigate by Captain Warren, R. N.

Communications received from Iver M'Iver (too late for this week)—Mr. Pine—Mr. R. Simpson—Mr. Brackenbury—An Old Mechanic.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price 6*d*. Also, the volume complete, in boards, price 9*s*. 6*d*.

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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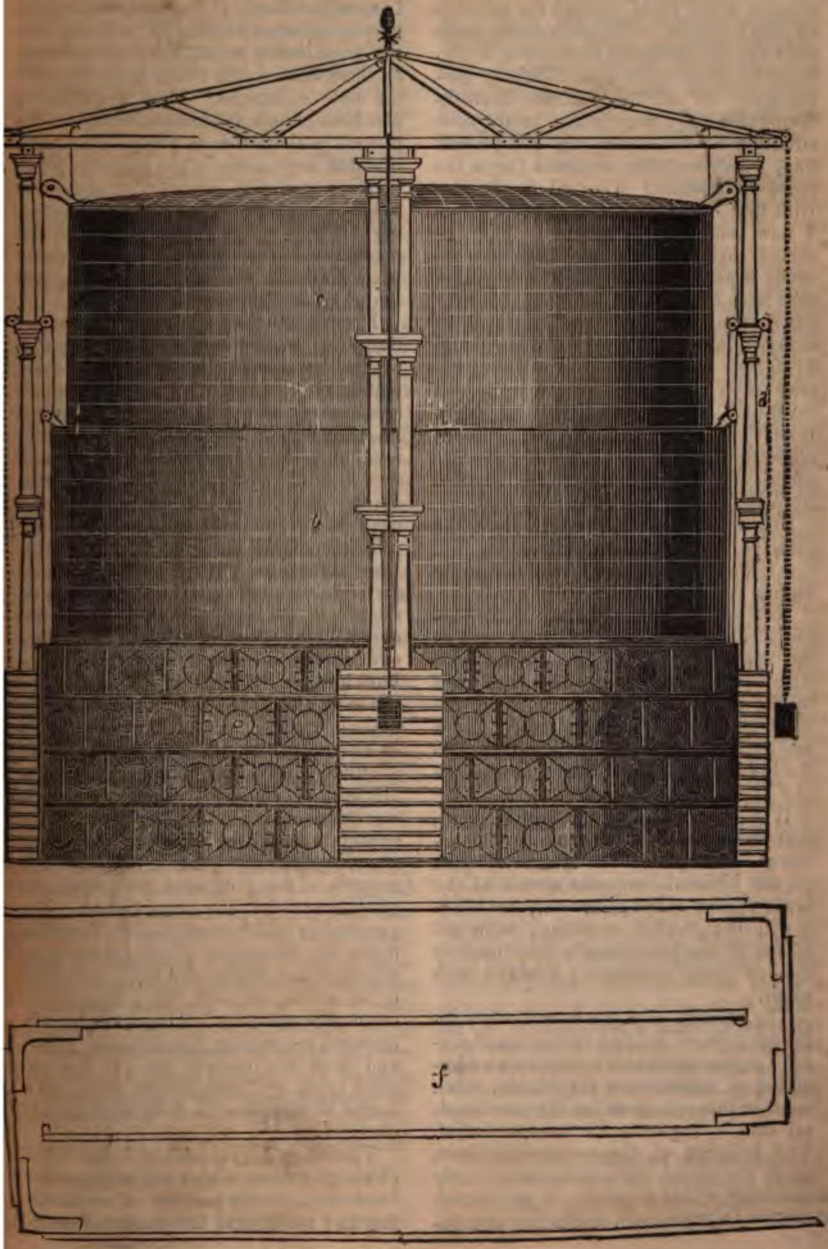
HUTCHISON'S DOUBLE-LIFTING GASOMETER.



HUTCHISON'S DOUBLE-LIFTING GASOMETER.

Sir,—The many valuable inventions, a knowledge of which have been communicated to the world through the columns of your excellent work, has induced me to send you the following description of Mr. Stephen Hutchison's double-lifting gasometer. Of all the various improvements that have been made in the construction of machinery in the present day, I believe there are none (upon the score of economy) of equal importance with that ingenious contrivance of which I now send you an account. The immense saving of capital which has already been effected by those Companies that have adopted this gasometer, amply guarantees my speaking in terms of commendation of its excellence; and I should not have attempted to bestow such unqualified praise upon this invention, were I not entitled to do so from my having had frequent personal opportunities of witnessing the numerous practical advantages that have resulted from bringing it into operation.

The accompanying sketches show the principle of this gasometer.

a is the tank; *b*, the lower, and *c* the higher divisions.

Nothing can be more beautifully simple, and, at the same time, so efficient, as the method by which one gasometer is suspended by the other. This is effected by the addition of a hydraulic-cup to the lower rim of the upper gasometer, and a reversed cup or catch being attached to the lower one, both of which are shown at *f* in the enlarged section, fig. 2.

It will be seen by this arrangement, that immediately the higher division receives its complement of gas, it receives in the hydraulic-cup the clutch of the lower portion of the gasometer, and raises it with the greatest accuracy; while all escape of gas is effectually prevented by the cup being continually charged with water.

The erection of a gas-manufactory for the purpose of lighting even a small district, or inconsiderable town, is an undertaking of comparative magnitude, when we take into consideration the great capital that is requisite for its completion. The building of the gasometers alone, upon the usual plan, consumes nearly *two-thirds of the capital.* A single tank *of limited dimensions,* including the expense of building, will cost from 6 to 800*l.*; and a gas establishment, on a small scale, cannot carry on its operations without three or four gasometers. I mention these circumstances for the purpose of more effectually pointing out the great saving which has been effected by those Companies which have adopted the new gasometer. This invention of Mr. Hutchison's has excited considerable interest in the minds of parties who have invested large sums in gas property, as it involves the very *important question*—Whether a gasometer, capable of containing 100,000 cubic feet of gas, can be erected at a less sum than has usually been paid for one which contains less than half the above quantity?

It has often been a subject of surprise, that men of distinguished professional reputation should be so diametrically opposed in their opinions with respect to mechanical improvements which time has shown to be of the highest benefit to mankind. But in no instance, that I can recollect, did so remarkable a difference of opinion exist as was exhibited at the time Mr. Hutchison made known the principle of his gasometer. Gentlemen who have been professionally engaged for more than twenty years in the manufacture of coal-gas, unhesitatingly condemned the double-lifting gasometer; and during the erection of the one at Vauxhall, individuals of acknowledged scientific abilities expressed themselves in terms of ridicule, at what they considered an attempt which must inevitably prove abortive. Notwithstanding the formidable host of engineers whose opposition was strenuously exerted against him, the expectations of the inventor have been most successfully realised, and the correctness of his judgment, as a civil engineer, satisfactorily established. The gasometers which were built at Vauxhall under the directions of this gentleman, although the largest and most capacious in the world, act with the greatest precision and accuracy. They have been in constant use during the last two years; and from the moment the gas first entered them, up to the present time, not a single interruption to their working has occurred.

The many improvements, independent of his gasometer, which this engineer has introduced for the purpose of economising and facilitating the process of manufacturing gas, has had an extraordinary effect in reducing its price. To his ingenuity, and to the confidence which the proprietors of the London Gas Company had in his abilities, the public of this metropolis owe that reduction (a reduction of 40 per cent.) which has now taken place in the price of an article which has become almost an indispensable necessary of life.

CLOVIS.

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MR. HERAPATH'S RAILWAY THEOREMS.

Sir,—I am sorry to observe that my opponent, Mr. Herapath, should have been under the miserable necessity of becoming his own trumpeter, and also that he should have been so imprudent as to give deductions from a theorem of Iver M'Iver's, which theorem Iver M'Iver has not yet given himself (pray is Mr. Herapath an Irishman?) The calculations in Mr. Herapath's last notable article (signed "A Looker-on") are founded on one of the blunders of Anti-Carper (*iterum* Crispinus); and as it is one which I promised (No. 646, p. 250) to make some remarks upon, I shall now fulfil that promise. Mr. Herapath, in speaking of the theorem, $v = \sqrt{V^2 - 2\,g\,S \sin. i} \cdot \frac{15}{22} = \sqrt{V^2 - 2\,g\,h} \cdot \frac{15}{22}$ (No. 643, pp. 194, 195) remarks, that when $V = o$, and $g = 32$, then $v = 5{\cdot}45\sqrt{-h} =$ imaginary quantity, &c. Here I must distinctly inform Mr. Herapath, that he has either been guilty of a wilful misrepresentation of the fact, or that he has presumed to give an opinion on a subject that he is grossly ignorant of; for he knows, or, from his vaunted pretensions, he ought to know, that this theorem $v = \sqrt{V^2 - 2 g S \sin. i}$ which is given by almost every writer on dynamics, supposes that V has a *real* existence, and that it is the only force which gives existence to v and S. So that when V ceases to exist, both S and v kick the bucket; or, in the language of algebra, when $V = o$, S and v both become o, and the equation assumes the form $o = \sqrt{o - o}$. But Mr. Herapath goes a step further, *for he supposes that when $V = o$, S still retains its negative* value! and then he produces the absurd equation,

$$v = \sqrt{-h} \cdot 5{\cdot}45 \,!!!$$

And from the said absurd equation Mr. Herapath, in his profound wisdom, deduces certain results, which he (in order to keep in existence his own sickly theorems, or to feed his own unsatiable vanity) wishes to father upon me.

I am, Sir, yours, &c.

IVER M'IVER.

Jan. 21, 1836.

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RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal* for Nov.)

APPARATUS FOR REGULATING THE HEIGHT OF WATER IN STEAM-BOILERS, *Jesse Fox*.—This apparatus is described as resembling "a common force pump, having one valve, a cylinder, piston, or plunger, one inch in diameter, and making a stroke of four inches. It is attached to the boiler at the water line, and is kept in constant operation, and fills from, and discharges itself again into, the boiler; it operates upon the supply pump. When the water in the boiler is below this pump, or apparatus, it fills with steam from the boiler, and the valve between the pump and the boiler being shut, and pressure applied to the piston, or plunger, the steam in the pump is compressed; by taking advantage of this circumstance, the supply pump is put into gear, or motion, and continues until the water in the boiler rises to the pump, when it fills with water; and, although pressure is applied upon the piston, or plunger—water being incompressible—it will not yield, by which circumstance the supply pump is thrown out of gear, or stopped: thus stopping and starting, the water in the boiler is kept constantly at the point, or nearly so, to which the apparatus is attached."

If this apparatus would answer the proposed purpose, so also would several contrivances which have preceded it; but we are convinced that all plans must fail which depend upon the assumption that water highly heated in a boiler, and from which steam is escapihg at every stroke of the piston to supply the cylindes, is in a quiescent state, like cold water in a reservoir. What engineer does not know that water may be blown into the cylinder through the staam pipe, when, at the same time, there is not a drop too much in the boiler?

TREAD PUMP, *Heinrich Bachmann*.—We are told that, "by the application of this machinery, the long desired object is attained—to raise, with a trifling exertion of power, a much larger quantity of water in a shorter time. This is effected by substituting, in the place of the common pump-handle, a pendulum fastened to the middle of an iron axletree, on one end of which a double treading board is fixed, and on the other end a cog wheel, moving in a rack, which is fastened to the lower end of the lever beam. By treading the board, the pendulum is put into a swinging motion, which causes the cog wheel to move in the rack, and to draw the lever beam up and down."

"By means of this invention, it is possible to draw up water out of the *deepest* well, in large quantities, and with perfect ease."

A piston is described and figured, and its employment made a part of the invention claimed, but for what reason we are unable to ascertain, as its general construction is not new, and no particular parts are pointed out by the patentee as possessing this character.

This pump, we are informed, may be made to answer the purpose of a fire-engine, where water is not to be raised "more than twenty feet higher as the spot where the pump stands." No account whatever is taken of the depth of the well, or reservoir, from which the water is to be obtained; a circumstance worthy of some consideration. But the fact is, that the whole affair manifests a want of acquaintance with the subject of hydraulics, as is evinced by the initiatory declaration, that, by the method laid down, water may be obtained in large quantities, from the deepest well, with a trifling exertion of power. In the drawing which accompanies the specification, a man is represented as treading the double board, much at his ease, and he might as well "stand at ease," as to attempt, by his individual power, however applied, to draw water in large quantities from one of the deepest wells. A man has the power to raise a given weight to a given height in a given time, and it is not possible, by any mechanical arrangement, to enable him to do more; his power may be applied disadvantageously; and, in consequence thereof, a portion of his efforts be wasted; to prevent which, the skill of the machinist is called forth; but beyond this point, if he have skill, he does not attempt to go.

New Material for Stuffing Beds, Mattrasses, &c., *Joseph C. Smith*.—The new material to be employed is palm leaf, which is to be reduced, by heckling, into filaments, or fibres; these are then to be spun into ropes, and so tightly twisted as to kink the spun material into balls; these are to be put into a steam oven, and so baked as to fix the curl, or twist; when untwisted, it is "a light, elastic, and durable article for stuffing."

Improved Mode of Generating Steam, *William Scarborough*.—A large portion of the specification of this patent is devoted to the theoretical views of the author, upon an assumption of the truth of which he founds his improvement: we, however, dissent altogether from his theory, and doubt the advantage of the practice to which it leads. He first assumes, correctly, that the steam generated in a boiler presses upon the surface of the water with a force equal to its pressure on the other parts of the boiler. "It is next assumed, that, in proportion to the extent of this pressure, the particles, or molecules, of this water are *compacted* together, and that in proportion to the compaction is the difficulty of obtaining admission or entrance for the caloric, or heat, to the various particles or molecules of this water, which are to furnish the required vapour or steam." Much pains are then taken to prove "that this is no false theory;" but throughout the whole the non-escape of steam is confounded with, or mistaken for, the non-entrance of caloric; the author forgetting that the more dense bodies are generally the best conductors."

"What I claim as my own invention for generating steam of high or low pressure, is the principles of transmitting the caloric through the medium of small horizontal, vertical, or diagonal pipes or tubes, at once to the centre, or other part of the fluid, which will have the effect of preventing the compacting or compressing against the more central and cooler parts of the said fluid, in consequence of the greater expansion of that part of it nearest in contact with the caloric.

"Also raising the water from below, and discharging the same through the apex of the cone, or through the pipes or tubes, above or below the level of the water in the boiler. There may be many methods of producing the same effect, but I claim the principle as set forth in my specification, however performed."

The cones named are situated, and to operate something like the circulators of Mr. Perkins.

Improvement in Tanning, *Isaac M. Belote*.—The skins, after being cleaned from the lime, are to be put into a vat, with liquid enough to cover them, which liquid is prepared by adding to water and a bushel of wheat bran added for every five hides, and allowing it to ferment; they are to be handled once a day for four or five days: after this, they are to be immersed in ooze from Spanish or chestnut oak, in which they are to be handled twice a day for ten days, when they will be of a good colour.

A mixture is then to be made of half a pound of common salt, two ounces of ginger, and two ounces of alum, for a common size hide, and this is to be rubbed in on the flesh side; the hides are then to be bulked down for two or three days, to allow them to absorb the materials. These operations are to be succeeded by a good bark for thirty days in the ooze used for colouring; this is to be twice renewed at the end of thirty days, by which time it is said that leather will be produced equal to that usually obtained by twelve months' tanning.

The claim "in the above described mode of tanning is to the application of *ginger* together with salt and alum for hastening the process of the ooze." What good the ginger may produce, we cannot divine; salt and alum have both been used before in the tanning process.

IMPROVEMENTS IN LOCOMOTIVE ENGINE WHEELS AND BOILERS, *Matthias W. Baldwin, C. E.*—It is well known, says Mr. Baldwin, to engineers upon rail-roads, that, in running upon iron tracks, the wrought tire forming the tread of the wheel, when the wheel is altogether of iron, is gradually stretched, and becomes loose; to prevent this rims of wood have been interposed between the tire, and the rim of a cast-iron wheel; but I have invented an improved mode of interposing wood, which, whilst it is more simple than the plans heretofore adopted, is equally efficacious, and secures certain other advantages not attained by the methods alluded to. I cast the hub and spokes of the wheel of common soft iron, without a rim; but the spokes have projections on their outer ends, forming sections of a rim, such as would be produced by casting it with a flat rim, and afterwards dividing this by cutting out a piece therefrom, two or three inches wide, midway between each spoke; these projections form suitable bearings within the rim, by which the spokes are to be surrounded. It will be perceived, that, in making such a casting, the hub may be made solid, and without bands. The rim may be made in various ways: that is, it may be entirely of cast, or entirely of wrought, iron; or it may be in part of cast iron, with a wrought iron tire: I intend, in general, however, to make the rim of cast iron, chilled in the usual manner, by which means the strain which always exists when the spokes and rim are cast together will be prevented. But the main object in view is the interposing between the spokes and the rim a layer of wood, or other substance, possessing a similar degree of elasticity: *for this purpose the spokes are cast of such length as will* admit of its introduction, leaving a space between their ends and the interior of the rim, say of one inch, more or less.

To attach the spokes and the rim to each other, I cast the rim with a flanch on one side, projecting inwards, so as to form a bearing for the projecting ends of the spokes, when the two parts are put together; screw bolts are then passed through the ends of each spoke, and through the flanch, by which means they are firmly united to each other. The pieces of wood between the spokes and the rim may be secured to their places in various ways; as, for example, the projecting ends of the spokes may be made flat, so that the pieces of wood will also be flat on the side which bears upon them, and curved where they bear upon the interior of the rim; this will prevent all tendency to motion endwise, whilst there may be a projecting fillet upon the end of the spoke to check them sideways; there may, also, be a plate cast separately from the spokes, through which the screw bolts may pass, so as to draw them down firmly upon the wood, to confine it in its place. The drawing deposited in the patent-office will illustrate these methods; but, without this, a competent workman would find no difficulty on this point. A hub and spokes, cast in this way, may serve for many rims, and these latter may be renewed without the necessity of taking the arms from the axles. Advertin next to the branch of his patent which relates to steam-boilers, Mr. Baldwin observes—

"The plan now pursued of putting the tubes, which serves as flues, into the boilers of locomotive engines, is to pass them through the heads of the boilers, and then to drive ferules, or thimbles, as they are called, into each end of the tube; this, of course, diminishes the size of the tube at each end, causing them to become obstructed more readily by coals, soot, and dust, and rendering it more difficult to clean them out, than would be the case, were they of equal size throughout. To obviate this difficulty, I drive the ferule or thimble on to the outside of the projecting ends of the tube, and solder them in their places; by this means rendering the tubes much stronger than they are in the former way, and leaving them of the same diameter throughout."

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EXPERIMENTS ON THE INFLUENCE OF COLOUR, AND OF ROUGH AND SMOOTH SURFACES ON THE RADIATION OF NON-LUMINOUS HEAT.

The following table presents the general results of an extensive series of experiments lately made by Professors Bache and Courtenay, of the Pennsylvania University, for the purpose of ascertaining the radiating powers of differently coloured substances (coated-tin cylinders were those employed in the experiments) and rough and smooth surfaces. The experiments are detailed at length in the *Journal of the Franklin Institute* for November last. From the remarks subjoined to the table by Professor Bache, it will be seen that there are *philosophical* as well as *vulgar* errors in vogue that require correction.

Number.	Nature of Coating.	Colour.	Number of Cylinders.	Date of Experiment.	Time of Cooling.	Remarks on Surface.
					Seconds.	
1	Litmus blue	Blue	3	Oct. 31	728	
2	Prussian blue	Blue	3	25	729	Rough.
3	Ammoniacal Sulphate of copper	Greenish blue	2	Nov. 6	789	Rough.
4	Per-oxide of manganese	Brownish black	2	18	804	Not shining, but uniform.
5	India ink	Black	3	17	804	Not smooth.
6	Bi-chromate of potassa	Brown	3	1	810	Streaked, streaks smooth.
7	India ink	Black	3	18	817	Smooth.
8	Alkanet	Crimson	3	11	828	Not shining, but uniform.
9	Carbonate of lead in oil of lavender	White	3	21	830	Smooth, not shining.
10	Sulphuret of lead	Black	3	21	837	
11	Alkanet blue	Blue	3	11	838	
12	Carbonate of magnesia	White	3	Oct. 13	846	Rough.
13	Carbonate of lead in gum	White	1	24	864	Smooth.
14	Carbonate of lime	Dingy white	3	11	865	Medium.
15	Vermilion	Red	1	25	872	Smooth.
16	Sulphate of baryta	White	4	Nov. 15	873	Rough, bluelsh white.
17	Golden sulphuret of antimony	Brown	1	Oct. 31	909	Smooth, in streaks
18	Indigo	Blue	2	Nov. 11	912	Smooth.
19	Cochineal	Crimson	4	1	944	Smooth.
20	Red lead	Orange	1	6	952	Smooth.
21	Sulphate of baryta	White	4	21	957	Medium.
22	Plumbago	Black	1	17	974	Not shining, but uniform.
23	Chromate of lead	Yellow	4	6	977	Smooth.
24	Gamboge	Olive green	1	20	1005	Smooth, in streaks
25	Bi-sulphuret of tin	Yellow	5	Oct. 31	1085	Smooth.

Remarks by Professor Bache.—The results thus exhibited are decidedly unfavourable to the specific effect of colour in determining the radiating powers of bodies. Blue is above black at the beginning of the table, and occurs again in the eighteenth place. Although the first seven numbers are blue or black, the ninth, tenth, eleventh, and twelfth, are white, black, blue, and white, respectively. Red occupies the eighth and nineteenth places, and then an intermediate one, namely, the fifteenth. White is in the greater number of cases in the middle part of the table, ranging close to black.

The alleged advantages of dark clothing during cold weather, thus seems to have been too hastily inferred; and it appears that, provided the person is not exposed to the sun, the particular colour of the clothing is not of real importance.

If colour is not a determining quality, neither does roughness appear to be so, for though generally the smooth surfaces are lower on the list, this is not universal. The rough sulphate of baryta is lower on the list than the smooth carbonate of lead. Plumbago occupies a low place, and India ink a comparatively high one.

The best radiators do not appear to belong to any particular class of bodies; litmus blue and Prussian blue are side by side, while sulphuret of lead, and the bi-sulphuret of tin, are fifteen numbers apart.

If the results be admitted as decisive of the radiating powers of the bodies used, they show that each substance has a specific power not depending upon chemical composition, nor upon colour. I do not claim to found such a conclusion upon the experiments; their object has been before stated, and if they shall prevent the introduction of an inference from an imperfect induction, as a law of science, the labour bestowed upon them will be amply recompensed.*

PARLIAMENTARY EVIDENCE ON ACCIDENTS IN MINES.

(Continued from p. 319.)

Examination of Mr. George Upton, continued:

And you make the orifice sufficiently large for that purpose?—Yes; it need not be nicely calculated; if it were a little more close or a little more open, it would not, perhaps, make much difference in the action of the lamp. An objection has been made which, perhaps, I may allude to, that it is a disadvantage the glass being on the outside: it was determined to place it on the outside, after a great deal of consideration and a great many experiments. It was found that the glass was in less danger from any external accident than from the risk of coming in contact with the flame; for if it were inside, and the lamp were to be put in a small degree out of the perpendicular, the flame would come in contact with the glass, and would be very likely to break it. Another advantage of the glass being outside the gauze, which is not very immaterial, is, that it keeps the wire-gauze clean, and free from the floating dust which, I am told, is a very great inconvenience, and sometimes chokes up the meshes of the wire-gauze.

Suppose the glass to be perfect for the effect for which you use it, causing the current of air to pass down the lamp, what is the advantage of the gauze above the lamp?—The gauze is put there in case of an accident, such as the glass breaking; it would otherwise do as well without. In fact, the first lamps Sir Humphrey Davy made were entirely without wire-gauze; he did not then seem to have any notion that wire-gauze was necessary. Concentric rings were placed both at the top and the bottom of the lamps referred to; and I believe this omission of the wire-gauze in them led to the contention between him and Mr. Stephenson, or Mr. Stephenson's friends, as to the validity of his (Sir H. Davy's) claim on that point.

Supposing the glass to break, the lamp is subject to all the accidents of a Davy-lamp?—Yes, it becomes a Davy lamp at once, and is no worse or better, except that it has perhaps this advantage: the gauze having been less liable to accident from its previous covering, is likely to be more perfect than the gauze of the Davy-lamp, which is daily and hourly exposed to external friction and accidents. It being of a very delicate nature, it is very likely, and I have no doubt very frequently is subject to small derangements in its texture, which may escape the eye of the person whose duty it is to inspect it.

Then none of those disadvantages would arise to the Davy-lamp, with the common glass over it?—The common Davy-lamp would go out with the glass over it.

As far as keeping it clean?—Yes; but it would not act with a glass, and therefore a glass could not be so applied.

The principal advantage of your lamp is, that the air which enters the lamp is directed downwards?—Yes, in its way to the wick.

You also attach value to the rising cap, as being readily calculated to admit just a sufficient quantity of air, either of the atmosphere or combined with carburetted hydrogen, to preserve the combustion in the lamp?—Yes. [*The Witness lighted the lamp.*] The Committee will observe that the taper will not burn with the wick as in the Davy-lamp.

Then, by the experiment of lighting the two, taper and wick, which you have just performed, under the glass, you exhaust the supply of air merely sufficient for one, and thus demonstrate the advantage of the surrounding glass chamber, as depriving the lamp of any obnoxious vapour from the surrounding parts of the mine?—Yes.

Suppose the flame of the wick were near the top of the lamp, would not the gas reach it and be dangerous?—This is prevented by the following means: The flame of the wick, when acted on by inflammable air, instead of coming with any force against the top of the lamp, as with the Davy-lamp, rises merely as a smoky column, gradually narrowing at its extremity. The fact is, that flame cannot live with any force in an atmosphere of this kind: this has just been shown by the taper going out, while the wick continued burning, consequently the iron wire could not get red hot in such a situation.

Is not the heat of that part of flame which is not visible often stronger than that which is visible?—In some cases where it is least seen it is so, but not in this.

Supposing the extension of the flame, which always takes place in carburetted hydrogen, and that part of the flame which is not visible, which has greater heat than that which is visible, might not the gas explode in that point?—The flame could not, in such a case, get through the double cap of wire-gauze, as the wire-gauze cap would be protected by the continual passage of air through it not capable of supporting flame.

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* The scientific reader need not be reminded that these remarks *do not bear upon the radiation or absorption of heat accompanying light.*

You are aware that that part in a blow-pipe beyond the visible flame is the hottest?—Yes; but the blow-pipe has the advantage of pure atmospheric air, while the flame in this lamp above the cone which surrounds the wick, has all the disadvantage of meeting air that will not support combustion, at least, not to any great extent; consequently the flame would, under such circumstances, be very feeble.

But much more air comes from below the light than is required to keep the light burning? — Yes; but its power of supporting flame has been taken from it by its previous use, for it is a known chemical fact, that air that has supported ignition will not again support it.

In all the experiments before alluded to, you of courſe made use of fictitious gases, prepared for the purpose?—Yes.

Have you ever tried your lamp with the carburetted hydrogen as evolved in the mines?—Yes.

Were the results similar?—They were similar as to the flame passing; but to my surprise and to the surprise of the persons present, it passed much more quickly than carburetted hydrogen. The fire-damp, instead of appearing to be the least inflammable of combustible gases, as far as could be judged by its effects upon the lamp, appeared to be quicker in its action in passing through the wire-gauze, which became heated to a white heat almost in an instant.

In that case you must have forced the current with a very strong impetus upon the gauze?—Not more than Mr. Roberts considered that a blower might force it. This experiment was tried in a coal mine near Dudley; there were at least twenty miners present.

That is, supposing it had been close to the blower?—Yes. I have omitted to mention one circumstance, which is, perhaps, material in this inquiry. A meeting in March, 1834, of about forty of the principal mine owners of the county of Staffordshire took place at the gas-works at West Bromwich, to witness experiments on the Davy-lamp and the new lamp: these gentlemen had heard with surprise that the Davy-lamp was an insecure instrument, and nothing but ocular demonstration would convince them of the truth of this assertion. As they had been apprised by letter of the purport of the meeting several days previously, they were prepared with a number of lamps which they had been in the habit of using in the mines, as far as those lamps are used in Staffordshire, which is very limited. They had also a number of their men present; they were most of them persons of long experience in working coal mines. When they saw that none of their lamps would sustain the action of a jet of gas, they were much surprised, as the lamps had hitherto been considered safe.

From all those experiments, and assuming the fact that the damp found in the mines is still more explosive than the fictitious gases obtained by chemical preparation, you have come to the conclusion that Sir Humphrey Davy's lamp, undar certain circumstances, is not a safe instrument?—I consider that Sir Humphrey Davy's lamp, in most of the uses which he recommends it for, and which uses have been sanctioned by several gentlemen of great experience, is extremely dangerous, and must lead occasionally to such catastrophes as those which have occurred lately at Springwell and Wallsend collieries.

And the only contingencies that you apprehend as likely to create danger in your own lamp, is the fracture of the glass and of the gauze, and the burning of the top of the lamp?—The burning of the top of the lamp I think impossible, from the experiments I have seen, and from the nature of the atmosphere at the top of the lamp.

Then the only contingencies are, the destruction of the lamp, that is to say, a fracture of the glass and a fracture of the gauze?—Yes.

Do not you think that very much depends upon the size of the aperture at the top of the gauze?—No; the cap or cone immediately surrounding the wick has an opening at the top, and that circumscribes the size of the flame of the lamp, when filled with inflammable air. If that aperture be an inch in diameter, the flame would be an inch also in diameter; if it were half an inch, it would be half an inch only; and if it were two inches, the flame would be two inches. That is the only part of the lamp in which there need be any great exactness, and that exactness merely relates to having a proper space between the wire gauze and the flame of the wick.

Supposing there were no glass at all, would not your lamp be equally safe with that aperture?—No; the lamp would then fill it with flame, as the Davy-lamp does.

The principle then is, that the supply either of atmospheric air, or combined with light carburetted hydrogen gas, is equal, and no more than adequate, for the supply of the wick?—No, that is not the principle which we have made the lamp upon; it might be regulated on such a principle, if necessary. The point which we have had in view, and which we have considered all that is necessary, is to make the aperture sufficiently large to let the air pass from the wick.

Supposing there were some difficulty in the current going under the flame, if the opening at the top were sufficiently large, might not another current go by the sides of the glass, while the current from the lamp went up the centre?—The lamp would go out in that case.

The result of your experiment is such as to lead you to believe that too much is attributed to the ignorance and carelessness of the miner, and too little to the dangerous circumstances in which the lamp is placed?—I believe so.

Will you describe what the general opinions of the miners are as to the safety and the light of the lamp?—In Staffordshire there is one universal opinion as to its safety. I did not meet with a single instance of any person who had the least doubt of its safety; but the miners in Staffordshire, particularly in the very thick seams, do not work with it.

Have you ever in any place had a conversation with the men as to the light given by the Davy-lamp?—Yes; they stated that it was quite inadequate for the purpose for which they wanted it in the thick mines, to give them such a light as they could work by. I beg to observe, that the light of the Davy-lamp cannot be increased without destroying its safety, even as far as it now extends. It is known that the heat of the flame is according to its bulk, and the consequence would be, that if Sir H. Davy had increased the cylinder of his wire-gauze lamp to the extent necessary for a larger wick, the power of such a body of flame would be so great as to oxydize or to burn the gauze to pieces in a short time.

Have you ever conversed with the men in the north of England, where it is used, as to the light given by the lamp compared with candles?—No, I have not; in the thin seams much more light would be got from it than in the thick ones. The men were very anxious to get a better light than the Davy-lamp gave them. They were very anxious to work with lamps on account of the known or supposed safety of them over candles, but they found it impossible, as I have before stated, to work with the light of the Davy-lamp in the thick mines.

Mr. John Buddle, Coal-Viewer, examined:

Produces a diagram, showing a plan of the workings of the Bensham seam at Wallsend colliery, at the time the explosion happened, on the 23rd October, 1821, when fifty-two lives were lost.

To what extent had those workings been conducted at that period?—There was not one place in the pit 100 yards from the bottom *of the shaft. I found* the seam prodigiously fiery, so much so that the coal itself afforded gas enough to light the pit.

Was that independent of any particular fissure or track?—Yes; I simply drilled a hole into the solid coal and stuck a tin pipe into the aperture, surrounded it with clay and lighted it, and I had immediately a gas light; the quantity of gas evolved from the coal was such, that in every one of those places I had nothing to do but to set a candle, and then could set a thousand fissures on fire; the whole face of the working was a gas-pipe from every pore of the coal, and when the shots were fired for blasting down the coal, they generally set fire to the gas as it was evolved from the coal. The men had what we called dusters or wet sacks on their jackets, by which, as soon as the gas began burning, they knocked the flame out, but sometimes that might not be sufficient, and in this very pit I had in the main-coal seam two cannons, because I found concussion the best mode of putting out flame, when inaccessible to dusting.

What size were those pieces?—I had them made of a peculiar construction; they are made of malleable iron, and the bores are conical, about two inches and a half in diameter at the muzzle; the depth of the barrel is not more than fourteen inches, and we charge them the same as charging a shot, that is, we put in a quantity of powder, and stem or tamp them with oakum driven down by a heavy maul, the object being concussion.

What quantity of powder would you insert?—I should suppose about half a pound, from a third to half a pound.

And this you have found successful in extinguishing fire?—Yes, I have extinguished gas fires that were not accessible by any possible means; it is a thing which I think ought to be generally known, because the immense concussion will knock out the flame of inflammable air when it is not accessible. I have succeeded in the top of one of those gasometers when the flame has run into the goafs or wastes, by explosion of one of those guns, and have thus shaken the flame out. My under-viewer performed a very clever feat some months ago in the Bensham seam at Wallsend; I gave him the highest credit for it: it occurred in a stow-board.

What do you mean by stow-board?—A place to deposit rubbish in, to avoid the expense of bringing it up the pipe; we were making a railroad between two dykes, which required the blasting down of the roof.

That is to obtain head room?—Yes, for the horses, and also for the deposition of rubbish from several adjacent parts of the mine. The Davy-lamps were used by positive orders during the stowing up of the board; however at last, when the board was nearly filled up, the stower came with his candle too near to the stones or end of the stowing; the gas oozing out of the stowboard from amongst the rubbish, caught hold of his light, and filled the interstices of the stowing with fire instantly, although there was a full current of air passing the board-end at the same time. It blazed furiously, and they could not get access to it; it was blazing out all across the place: it was about half-past two in the morning; I was called; the under-viewer had gone down, and he sent his son, the overman, to tell me the dilemma they were in, and wished to know what was to be done. I made the best of my way to the place, and when I arrived within a very little distance, I met some men who gave me the welcome intelligence that the fire was out. I came up to the place, and found a great quantity of smoke as I approached the place, and the men that were working in the current of air to leeward had been driven out by the strength of the smoke and after-damp. This fire was about five yards broad, and came flashing out of the top of the stowing, and the flame was playing backwards and forwards, sometimes apparently out, and then re-appearing again. When I came, I asked Mr. Atkinson, "how have you managed this?" and he said, "I knew the guns were not at hand, and I drilled a large hole into the rock on the right hand of the board, and made a gun of it." He put a large charge of powder into this hole, and about half stemmed or tamped it; he then exploded it, which produced the desired effect, as it instantly extinguished the flame. I gave Mr. Atkinson very great credit for his tact on this occasion; it showed great knowledge and judgment of the subject, and he effected by this expedient what there would have been great difficulty in accomplishing by any other means.

Is not the Bensham seam considered the most dirty seam you have?—It is, because it has been but partially worked as yet in the country.

Do not you imagine that that seam will become more safe as it is more explored?—I have no doubt but it will become more pure, because all the pillars that are standing firm become exhausted of gas in this colliery; each coal pillar, taken individually, after a certain time exhausts itself of its gas. It is very singular that this seam is only so fiery just on the north side of the Tyne. I speak of my own knowledge of the adjoining colliery of Jarrow, in the same seam; in the north part of the Jarrow colliery, which adjoins Wallsend, it is as fiery nearly as Wallsend; but at a few hundred yards to the south of Jarrow pit there is comparatively little inflammable air; and again, at the Manor Wallsend colliery, I am told that there is a *very trifling* quantity of gas.

Is there any fault between that part of the mine which is most fiery and the other side which is not fiery?—Yes; and I can speak more particularly to Jarrow: it is a fault, a slip-dyke, which makes a line of demarcation between the foul part of the mine and the comparatively clean part.

May not explosions occasionally result from the sudden discharge of electricity?—They may, but I have never known an explosion from lightning, except when it ignited the gas at the top of a pit. The Lawson mine pit was exploded by lightning; it is upwards of seventy fathoms; but the explosion took place at or above the surface; the pit itself had become a gas-pipe; something had happened, which I do not immediately recollect, to derange the ventilation. I had nothing to do with the colliery at the time, but I happened to be near the pit during the thunder-storm. The ventilation having been deranged, as already stated, the whole of the workings below were filled with gas, as well as the shaft, and consequently the shaft itself became a gas-pipe, and was then discharging what was generated below. This discharge was ascending in a current from the mouth of the pit when the thunder-storm came on; a flash of lightning ignited the gas, and a very heavy explosion immediately ensued.

Was there a current of atmospheric air passing through the mine at that time?—No, there was no ventilation in the pit at that moment.

Is it not known that carburetted hydrogen will not explode without a mixture of atmospheric air?—Yes.

How could the carburetted hydrogen which was in the pit explode, unless there was a current of air?—Because in such a case it supplies itself with a sufficient quantity of air to make it explode. If you fill a bottle with this gas and set fire to it at the mouth of the bottle, as long as there is an outward pressure it keeps burning at the mouth, but by-and-by it creeps down into the bottle, supplying itself with as much air as keeps it burning for awhile, and then explodes. I have known a pit shut up for three weeks as close as we could make it; the coal was of fire below, and we thought we had it sufficiently fastened up to prevent explosion, but at the end of three weeks it exploded, although the fire below could only have been supplied with fresh air through the fissures in the rubbish at the top of the pit.

You state this to show that it is impossible to prove how much atmospheric air may be supplied under those circumstances?—Yes; but it supplies enough to produce explosion. I went to see the havoc that had been made at the Lawson main pit, and had been there a short time, with a great number of other people, when another explosion, a most furious one, took place, when I was within eighteen feet of the top of the pit.

How far had the explosion passed into the workings?—I should conceive but a short distance; indeed, there was not much space below.

The explosion was in the pit?—Yes, and in part of the workings. There might be an interval of an hour and a half between the two explosions.

Was the explosion so immediate upon the flash of lightning as to leave no doubt of the lightning being the cause?—I cannot state the interval between the flash and the gas being perceived to be ignited, but I understood it to be instantaneous.

Have you ever thought of the possibility of the electric fluid descending through the earth, conducted by any metallic vein or otherwise, in such a body as to occasion subterranean explosion?—I have no reason to believe that it has occasioned subterranean explosion; but I know a fact, recorded by my father, of the engine-pump having acted as a conductor, and carried the electric fluid to the bottom of the pit.

And what were the consequences, as he described them?—Nothing injurious; the fluid ran down the pumps into the water at the bottom of the pit, and nothing excepting a considerable noise was occasioned.

What would your theory be, if the bottom of the shaft was in a foul state?—Explosion immediately, because in certain circumstances the gas may be fired by the electric spark.

Are the lamps in general use in the county of Northumberland made by the best lamp-maker in the town of Newcastle, Mr. Watson?—They are. I lately had reason to find fault with the manufacture of some lamps, and more especially with the gauze; that is not very lately, perhaps twelve months ago; for people were going round selling gauze cheap, which was not what it ought to be; and from that time I have found it useful to carry a piece of standard gauze in my pocket, one inch square, with a small lens, which enables me to examine the state of the gauze and cylinders accurately. When there is any doubt that the gauze is not the proper thing, my small lens (the same as is used by the Paisley manufacturers for examining their muslins) enables me at once to ascertain if the gauze is of the right sort. There is an aperture of a quarter of an inch square in the frame of the lens, which forms a proper gauge for the meshes of the gauze. This is a piece of the standard wire-gauze of the right size, and by placing this little instrument so, and looking through the lens, you may count the number of apertures in a quarter of an inch as a *multiple for a whole inch; that is what I call* my gauze gauge. The Committee will see by the lens that there is a kind of indentation that prevents the movement of the wires where they decussate when the workmen brushes the inside of the cylinder to clean it, so that he cannot displace the gauze by any ordinary application of the brush.

Was there any other defect in the gauze?—The irregularity of the interstices is to be apprehended. By placing the lens upon the cylinder in any lamp I immediately perceive whether the gauze is regularly made, and if it is in good order. The number of apertures per square inch in that standard size is about 784; it may vary between that and 800.

Have you ever met with any gauze so slightly constructed that the indentations you have spoken of were by no means perfect?—I have not examined any lately, for I have repudiated the whole of that sort of gauze; if it differs from the standard I do not allow it to be used, and I have prohibited the use of any such gauze. I have samples at every one of the shops where our Davy-lamps are repaired, with the strictest injunctions that no other gauze is to be used but what corresponds with that sample.

Is this gauze that you have made the one originally prescribed by Sir Humphrey Davy?—I think it is, as near as may be. I do not at this moment recollect the number of apertures which he prescribes; it depends upon the size of the wire; but in my very extensive practice I have found this to be perfectly safe.

But you have reason to suspect that imperfectly woven gauze is in use in certain places?—I believe it is. I have not been in any part of the kingdom, with the exception of Whitehaven and Workington, in the collieries, where the Davy-lamp seems to be considered a working implement; it is rather considered as a matter of curiosity or precaution to inspect certain places of the mine, to discover where gas may be found, rather than considering it as a working implement belonging to the mine. Now we consider it as an actual implement of our trade, as much as a pick or a maul; and hence it is that we have it under very strict regulation, and, I flatter myself, very good management. I may state that the number of Davys used in the collieries that I am immediately connected with varies from 1,000 to 1,500 in daily use; in the Marquis of Londonderry's collieries alone there are nearly 900 in daily use.

Having that large number constantly under your notice, what should you describe as the accidents to which they were most liable in their use?—Nothing, I conceive, but violence or injury arising from some extraneous cause. In nearly twenty years' practice I have only known one accident happen to the Davy, and I am not aware of any other having happened. I have never had any distinct proof of any explosion which has taken place from the lamp. I know that it is affirmed the late explosion at the Springwell colliery took place from the Davy-lamp; now I am utterly at a loss to conceive how that notion has prevailed. I was called in to a consultation, with other professional men, the day after the explosion there; and, to the best of my recollection, all the evidence that we had about the cause of the accident was, not that it had happened from the lamps, but from the want of the lamp; the intelligence I received was, that one particular part of the pit was discovered to be in a dangerous state, the overman sent the boy for the Davys; the last man that got out met that boy going in with the Davys, but whether he had ever arrived at his point of destination is unknown.

Have you ever formed any experiment upon the Davy-lamp, with a view of ascertaining what force is necessary to compel the passage of the flame through the gauze?—I have, not by myself, but in company with Sir Humphrey Davy; and I am very happy to have this opportunity of doing justice to the memory of my lamented friend, Sir Humphrey Davy, on this particular point. The lamentable accidents which, prior to the year 1815, had occurred in our neighbourhood naturally directed the attention of all humane persons to the subject. Sir Humphrey Davy was introduced to me by the late Bishop of Bristol, and he called upon me at the Wallsend colliery one day, to inquire into the nature and cause of this lamentable catastrophe; I explained to him as well as I was able the nature of our fiery mines, and that the great desideratum was a light that could be safely used in an explosive mixture. I had not the slightest idea myself of ever seeing such a thing accomplished. After a great deal of conversation with Sir Humphrey Davy, and he making himself perfectly acquainted with the nature of our mines, and what was wanted, just as we were parting he looked at me, and said, "I think I can do something for you." Thinking it was too much ever to be achieved, I gave him a look of incredulity; at the moment it was beyond my comprehension. However, smiling, he said, "Do not despair; I think I can do something for you in a very short time." I should think, to the best of my recollection, within fourteen days he wrote to me to say that he flattered himself he had done the thing; that he had made a discovery which would answer my object, namely, the procuring of a safe light in an explosive mixture. In a few days he sent me down two of the Davy-lamps, as *nearly as possible like that before the Committee; but I have one of our* working lamps with me. He told me that it would burn safely in an explosive mixture; that there was no hazard, except in exposing it to a strong current, by which the explosion would be passed through the gauze cylinder; he therefore cautioned me particularly against such an exposure; but he had a remedy for it. On the strength of his authority I took this lamp, without hesitation, into an explosive mixture. I first tried it in an explosive mixture on the surface, and then took it into a mine; and, to my astonishment and delight, it is impossible for me to express my feelings at the time when I first suspended the lamp in the mine, and saw it red hot; if it had been a monster destroyed, I could not have felt more exultation than I did. I said to those around me, "We have at last subdued this monster." Sir Humphrey some time afterwards came down to the north; he asked me if we had situations under ground where he could see the effect of his lamp. I told him I could show him in the pit every degree of inflammability in all stages, from the bare firing point up to the most inveterate mixture, the most highly explosive, that in fact would extinguish the lamp by explosion within the gauze cylinder. He went down this very pit with me in which the accident happened lately at Wallsend. I took him through all the various stages of explosive mixture; I showed him all the gradations, from the *thickening* of the air, which produces a little elongation of the flame, from a small admixture of inflammable air, to where we were working pillars, and where we were exposed to the discharge of large quantities of gas from the goaves. There we took the lamp, and suspended it for a length of time, till it was red hot, during which, at the same time, we exposed it to the ordinary impulse of the current of air, (there were currents of different degrees of inflammability); and in different parts we tried the lamp in a red-hot state, for a considerable length of time. I was present, and the underviewer, the overmen, and others were also present.

Can you define the time in hours and minutes?—No, I cannot, but I should suppose from a quarter of an hour to half an hour, during which Sir Humphrey was explaining to us the nature of the lamp; it was a lecture, in fact, upon the spot, and how the time might pass during that interval I cannot tell, but I think we might be down the mine for a period of two or three hours altogether. He then explained to us the danger of exposing the lamp to a strong current of gas, or even to a strong current of explosive mixture, endangered, as it would risk the passing of the flame through the gauze, but he pointed out a remedy at the same time for that contingency, and which we have always used; namely, by a tin screen, which slides upon the frame wires of the lamp, and encircles the circumference of the gauze cylinder to an extent of about one-half to two-thirds of its circumference. He could not there show us the effect of the passing of the explosion, to make us sensible of the danger to which we were exposed in that way, and teach us how to avoid it. But some time previously to that, I accompanied him to one of the Earl of Durham's collieries, to what is called the Morton West pit, where a very large blower from the shaft, not from the coal, but from a fissure in the stone, had been for many years discharging up the shaft, by a cast-iron pipe to the surface, in a similar manner to that which I have already described at Wallsend. We took a length of hose from an extinguishing engine, with the jet-pipe upon it, and attached that to the blower pipe at the top of the pit; it was held horizontally, and the jet was thrown very forcibly out of the nozzle of the pipe; the blower was sufficiently strong to propel the stream of gas across the engine-house. I well recollect the pipe was held at the entrance of the engine-house, and the jet passed the explosion nearly to the far end of the room, for it was very powerful; the distance that the blower fired it was from nine to twelve feet, I should think. I held the lamp in the direction of the jet, and not having seen it before, I was not very apprehensive of its firing. It did not fire at first but as I approached the end of the nozzle-pipe, the gauze became heated red-hot and passed the explosion. The flame was as long, or longer than the breadth of the engine-room; I remember that it burnt the nap off my great coat and spoiled it. This experiment was repeated over and over again. Lord Durham himself was present, and a great many other persons, professional men and others, were present on this occasion. The force of Sir Humphrey's remarks at the time was, "Now, gentlemen, you see the nature of the danger to which you are exposed in using the lamp, and I caution you to guard against it, in the manner I have shown you. This is to show the only case in which the lamp will explode, and I caution and warn you not to use it in any such case when you can avoid it, without using the shield." In fact, this is a kind of test to which the lamp never need be exposed in practice; we never have occasion to approach the mouth of a blower so close as to expose ourselves to the blast of the issuing gas. Blowers are very different from pipes, as instead of issuing out of a single orifice, as from the jet of the extinguishing-engine, they generally issue from a long crack or *thread* of indefinite extent; sometimes *the thread may be a foot or a yard long, and occasionally I have seen* them five yards and more long; when fired they generally form a sheet of fire, rather than a jet like a gas-pipe. In fact, I do not think I ever saw the orifice of a blower of any magnitude that was so small that I could not put my finger or even my fist into it; some parts of the crack or blower threads are close for a foot or two, and then open, and close again; and if you set all the orifices of one blower thread on fire, you may have it burning out in different places at the same time, but none exactly approaching to what you would call the end or nozzle of a pipe. The orifices are not circular, and consequently the jets from them are diffused, and do not form a concentrated blast. It cannot be necessary in any case to expose the Davy-lamp to the direct jet of gas from a blower. The only case in which I conceive danger can arise by exposing the Davy to the impulse of an explosive current is in travelling the gas-pipe drifts. Explosive mixtures occasionally occur there, when the current is moving with a velocity of from three to four feet per second, which is a palpable breeze, and sensibly biases the flame within the wire-gauze cylinder; in fact, it propels the flame against one side of the cylinder.

Is the Committee to understand that that is when the lamp is carried or when it is stationary in foul draught?—Either in the one case or the other.

You make no difference when the lamp is carried against the stream?—Yes, that causes a double impulse, if the person carrying the Davy is going with the same velocity to windward as the air is moving; but we use the lamp in this manner as little as we can; our rule is, to travel with the current of air as much as possible. All the people employed in this occupation, the waste-men, have shields upon their lamps, to shelter and prevent their being affected by the current; and, moreover, they carry their lamps in a particular manner when they are travelling either with or against the current, by which they shelter them by their bodies, and the shield is always opposed to the direction of the current.

Why is not the shield made of a transparent substance?—We do not find it necessary; the tin shield in some degree answers the purpose of a reflector, and the cheapness of the tin is also an object.

If it was a transparent substance it would give light upon that side as well, when the blast came?—Yes; but any thing in the shape of a lantern or lamp is much better not to give light on both sides, and it shows a more agreeable light with an opaque shield, especially when you are travelling in numbers together. The naked Davys do not afford so agreeable a light in travelling as those with shields, in my opinion.

The tin shields do not dazzle the eye so much?—They do not.

Though the danger is imminent in travelling those wastes, the men are so accustomed to it, and understand the theory as well as the practice of using the Davys so well, that you never knew an accident occur to them?—I never did. I can only say, that from the time of the invention of this lamp, and getting them introduced as quickly and as extensively as possible, I am quite certain that I have not for many years had less than 1,000 lamps a day using, and frequently 1,500, and I can state that I never have known an explosion happen from the Davy-lamp; not even one solitary instance. I have seen them in operation, and been with them myself in all possible varieties of explosive mixtures to which they can be exposed in our mines. From my experience, I have perfect confidence in them; and when I state, during the number of years (nearly twenty) which I have had those lamps in daily use, that I do not know of one single accident having happened from them, at least as far as my own experience goes, I think I am warranted in pronouncing the Davy-lamp to approximate as nearly to perfection as any instrument of human invention can do. This is my decided opinion.

When they are travelling those wastes with the Davy-lamp, the gas is constantly exploding in the lamp?—Not always; there are a thousand degrees of explosive mixture. In some cases the gauze cylinder is not quite filled with flame; a column of flame, about the thickness of your finger, goes up to the top of the cylinder, but does not fill it full. The heat collects at the top by the apex of the flame impinging on the gauze cap, and it then heats gradually downwards.

Have you examined any of the other lamps upon the table?—I have not. Mr. Upton was so good as to explain to me his improved lamp this morning.

What is your opinion of that lamp?—I think it a most excellent lamp, and in many cases it might be useful; but I must own I do not see any difference in principle from the lamp of Sir Humphrey Davy. I think, if I understand it rightly, it is neither more nor less than Sir Humphrey Davy's wire sieves. As an individual so deeply interested in the question of safety-lamps, both my life and property being staked upon them, I must express my gratitude to all those gentlemen who have so laudably interested themselves in attempting to improve them. I feel particularly obliged to all those persons who have done so. Dr. Clanny is a continual and indefatigable labourer in the vineyard, and I believe that he has the merit of having first directed public attention to the subject of safety-lamps. I am sure we have all but one object in view, and that is to arrive at the best possible lamp that we can. I am not sufficiently conversant with Mr. Upton's invention to know the precise difference in principle; but I have in my hand Sir Humphrey Davy's pamphlet, and I think the Committee will perceive that his first idea was to feed the flame through a series of tubes; whether they were circular or in any other shape, they formed the principle which led to the invention of the wire-gauze sieve, and ultimately to the wire-gauze cylinder. I do not, as I said before, discover any difference of principle between this and Mr. Upton's lamp; but there are many precautions taken in Mr. Upton's lamp which add to its safety; there is more strength in it; he combines the principle of the gauze, as it were, for a *dernier resort*, in case of the glass being broken; and he certainly feeds the flame immediately from below, and by that means prevents the explosion of the gas higher up the cylinder.

Does not his plan arrive at this point, that it prevents the flame of the lamp ever approaching the gauze itself?—Yes; I believe that is Mr. Upton's object, that is, to feed the flame without igniting the gauze in the gauze cylinder. As a greater security, Sir Humphrey Davy presented us with a double-gauze cylinder and a twill-gauze cylinder, to render the lamp more safe. I have a twill-gauze lamp with me now. These we have not found useful; they did not give sufficient light, and we soon got such confidence in the single gauze that we exploded the others. I do not know that double or twilled-gauze were used for more than six months after the invention of the Davy-lamp.

[*The Witness produced a twilled-gauze lamp.*]

Do you find a disinclination among the men to work with the Davy-lamp?—Not the slightest.

Do you think that the Davy-lamps give sufficient light?—In clean seams, or seams not interstratified with foreign matter, the men are willing to work with them without any extra remuneration, and take them as freely as candles.

Suppose the mine should require the introduction of the Davy-lamp, is it usual to make the men any allowance for using the lamp?—Not in clean seams, but in a foul seam, interspersed with stone, split coarse coal, iron pyrites or other foreign matter, which requires the collier to select the coals, they receive a greater remuneration for using lamps, on account of the greater trouble and the deficiency of light; for I must observe, that at the time Sir Humphrey Davy accompanied me down the pit, we tried the comparative intensity of the light between the lamp and the ordinary pit candle, and found that the Davy-lamp gave about one-fifth less light than the common pit candle. Then when the people are working in a foul seam we give them additional wages, called *consideration*, according to the extra labour and trouble it may require to clean the coals, but in a perfectly clean seam no consideration is allowed for using the Davys.

Do you observe any indisposition on the part of the colliers to use the Davy-lamps? —No, not where it is necessary.

Is there a readiness in the magistrates to punish?—There is; but the men have now taken up the subject themselves. On one occasion, where a man had taken off the top of his Davy in a dangerous place, I had him taken before the magistrates, who committed him to the house of correction for three months. The friends and relations of this man came to me to say that it was an exceedingly hard case; he had done it quite inadvertently; that he was a man of excellent character, and they wished me to intercede with the magistrates to mitigate his punishment. I said " It is all very true, but it is not quite so much my affair as it is that of the men; I do not wish to inflict punishment unnecessarily upon any man, but I think the colliers themselves are so much interested in this matter, that they should be the judges. If you will therefore get the men to petition the magistrates, I will join in it, as it is as much, or more, their affair than mine." The case was submitted to the men; they held a meeting, and I had deputation from them to state that they had maturely considered the case, and they thought that it was one which deserved the most severe punishment, as all their lives had been exposed to imminent danger by this man's heedlessness, and they therefore decided that he ought to undergo the full term of his punishment. I could not help lauding them for their decision, as I thought it was proper; and in that colliery I have never since had the slightest complaint of a want of care in the management of the Davys. This showed a spirit of correct feeling amongst the men, and was highly creditable to them. This was in the Benwell colliery.

From the period when Sir Humphrey Davy first produced his lamp to the time of his death, had you any further communications with him?—Very frequently; not only communications by letters, but I also visited Sir Humphrey Davy when I came to town, and he used to call upon me when he came to the north.

Did he ever express the hope that he should make improvements upon that lamp?—No; in fact I was so perfectly satisfied with what he had done, that I did not ask for any thing more; from *its simplicity* and portability *it amounted to every* thing I could desire. The travellers, for instance, the wastemen, whose business it is to work and travel in the wastes for six hours daily, with small intervals of rest, sitting down occasionally at their halting-places, they are frequently travelling through places not above three feet or four feet high (sometimes creeping), in a very uneasy attitude. None can do this sort of work but men in the constant habit of it, and they are obliged to sit down now and then to rest. Carrying this lamp for six hours in so constrained an attitude, renders it important that the lamp should be as light and portable as possible; and I question the ability of the strongest man to carry a lamp of that size for six hours [*pointing to a lamp of greater size on the table of the Committee*].

Is it your opinion that the loss of life in proportion has been much less since the introduction of the Davy-lamp?—No, I think not; but the causes of the loss, and the circumstances of the mines, are perfectly changed; the risk is very much increased.

And will continue to increase as the mines are worked off?—No; I do not think that is the cause; I think it is from the greater extent of pillar-working. The truth is, that several mines are now working, and several have been re-opened in consequence of the invention of the safety-lamp, that were deemed unworkable before; and I think I am warranted in stating that, but for the invention of the safety-lamp, there would scarcely at this time have been a single colliery in existence, to the east of Newcastle upon the banks of the Tyne, as well as in many other places.

In lieu of which, how many are there?—Six, I should think, at least, immediately on the banks of the river Tyne, on the south side, and not less than seven below the bridge of Newcastle, on the north side of the river.

Producing several hundreds of thousands of chaldrons annually?—Yes. In fact, several collieries have been re-opened by the aid of the Davy-lamp, which must otherwise have lain dormant.

Do you apprehend any advantage to the public from the competition arising from that bulk entering into the market?—I cannot but think so. I should think if we were deprived of the use of the Davy-lamp, all those collieries must instantly cease.

Would it not be very detrimental to the mining interest of the north of England were the coal-owners to be deprived of the use of candles?—It would be almost as bad as depriving them of the use of the Davy-lamp; because if you take away the candles, you take away the gunpowder and the produce of small coal, and waste would be so great that it would not be worth their while to go on.

Did Sir Humphrey Davy receive any acknowledgment for his services?—He would not receive any pecuniary reward, but he was presented with a service of plate.

Of value?—2,500*l.*

Did not Mr. Stephenson receive some reward?—He did.

What was it?—I do not know, but I believe it was 1,000*l.* I am quite sure that on every occasion, when any thing feasible has been presented to the notice of the coal-owners, they have given due attention to it.

Mr. George Stephenson, further examined:

The Committee understand that it is your wish to elucidate some portion of your evidence, by one or two further remarks. Will you have the goodness to make those remarks?—Having understood that evidence has been given here that Sir Humphrey Davy's lamp will explode the external atmosphere when it comes in contact with a sharp current of air, I think I can show the Committee how such a current may daily take place in the working of the coal. The custom of getting the coal in the north, is by boards of five or six yards wide; the coal is undermined first, about three feet in; it is then cut up at the two sides (if it is brought down by gunpowder, it is only cut up on one side; but if it is brought down by wedging, it is, generally speaking, cut up on both sides). Now, the lamp is placed in as convenient a situation as the miner can contrive, that it may give him all the light possible; it is generally hung upon a prop, set up for the purpose. The coal being undermined and brought down by wedges, if there were any inflammable gas in that part of the mine, it would be close to the face of the coal. The coal frequently comes down very suddenly, so that the men must run back to keep out of its way; sometimes they are not quick enough, that it comes upon them and kills them; but they run out of the way as fast as they can, not stopping to take hold of the lamp, which is left hanging. When the coal comes down there is an immense gush of wind, immediately arising from the falling of the coal driving the hydrogen gas on the face of the coal, that was before hanging out of the way of the lamp, immediately against it, with a current which is, I imagine, sufficient to drive the flame through the gauze, and fire the external atmosphere. Of course, if the mine is in an inflammable state, which it can be shown that it frequently is, an explosion must take place, and perhaps of a very considerable portion of the mine.

Have you ever known of an incident that would justify such a supposition?—I have. I have been frequently in a board myself with a candle, when there was not fire-damp, *and my candle has been* blown out as *described, by the falling* of the coal.

But you never heard of the gas exploding, either in a section of the mine or in a board-way, under those circumstances?—I have not myself. I imagine that some of the accidents that have happened, of which no one has been left to give account, may very likely have happened in the way I have described.

Then you fully admit that the lamp may be exploded by the increased current of air, do you not?—I do.

Jonathan Pereira, Esq., F.L.S., Chemical Lecturer at the London Hospital, &c., examined:

What is your opinion of Sir Humphrey Davy's lamp, as a security against the effects of carburetted hydrogen gas?—I do not think it is a security, because the lamp will allow the passage of the flame through it.

Will it allow the passage of the flame when suspended in the carburetted hydrogen gas, without motion?—I have never seen the flame pass through the wire-gauze when the lamp was at rest, and the gas not in motion. Under such circumstances the lamp may be safe, at least I have never seen it explode.

Have you seen it explode under other circumstances?—Repeatedly, when the lamp or the gas has been in motion. I was accustomed for years to show the Davy-lamp in lecture, and by certain experiments to demonstrate, as I then thought they did, the security of the lamp. The experiments are those usually shown in the lecture-room. I am now convinced they are fallacious. There are three methods mentioned by Sir Humphrey Davy, of proving the safety of the lamp: the first method (mentioned at p. 14, 15, of his work, on the "Safety-lamp for Coal-miners,") is to plunge the lamp into an explosive mixture contained in a large vessel; the second method (mentioned at p. 16 of Davy's before-mentioned work,) is to hang the lamp in a large glass receiver, through which a current of explosive gas is made to pass; the third method adopted by Sir Humphrey Davy, was tried on a "blower" in a coal-mine. He held the lamp in this blower, and though the wire-gauze soon became red hot, the flame did not pass until the gauze had reached a welding heat, and began to burn. (This is mentioned at p. 138 of his work.) Of course lecturers in London have no means of exposing it to a blower, and therefore they have usually employed as class-room experiments the two first-mentioned methods of trying the lamp. I have never found the lamp explode by either of those methods; but, as I have already remarked, they are fallacious experiments.

You think the lamp, if exposed to a current of explosive gas, decidedly unsafe?—Yes, certainly. I will not say it is absolutely safe when the lamp is not moved, and where there

rrent; but under such circumstances,
never seen it explode. I may perhaps
in what way I became convinced of
ecurity of it. Mr. Roberts has been
ed by me for some years as a manu-
, &c. of lamps; and on several occa-
e told me that he was certain the
mp was not "a safety-lamp." Al-
I was aware that Roberts had parti-
directed his attention to this subject,
m having been a working miner for
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inst the passage of flame, I confess I
Roberts was labouring under an
At his urgent and repeated request, I
ely consented to attend at Upton and
's manufactory, to see him prove, if
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e fallacy in his experiments. In a
inutes he showed me that flame
be made to pass through a Davy-
but thinking that the lamp he em-
might not be perfect, I sent for one
I had repeatedly tried, and which I
be a perfect instrument. The flame
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I then undertook a series of experi-
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enough to be luminous, so that a
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amp is plunged into a jar of explosive
e, a quantity of carbonic acid is imme-
formed, and this mixing with the
umed portion of the explosive mixture,
hes its combustibility, and there-
explosive powers. If, on the contrary,
pose the lamp to a current of an ex-
mixture, the carbonic acid which is
ed is immediately got rid of, (as well
nitrogen of the portion of atmospheric
loyed in carrying on the combustion,)
n the flame passes. A gentle motion
lamp, combined with the current of the gas, very much promotes the passage of the flame. If, for example, a lamp be held before a jet of gas until it becomes hot (a red heat is not essential), and then gently moved, the flame will pass, and the experiment may be repeated successively a number of times in the minute. Sir Humphrey Davy was well acquainted with this fact, that carbonic acid diminishes the explosive property of gaseous mixtures. At p. 10 of his work, he says:—"On mixing one part of carbonic acid or fixed air with seven parts of an explosive mixture of fire-damp, or one part of azote with six parts, their powers of exploding were destroyed." At p. 32 of his book, Sir Humphrey Davy states that "the consideration of these various facts led me to adopt a form of lamp in which the flame, by being supplied with only a limited quantity of air, should produce such a quantity of azote and carbonic acid as to prevent the explosion of the fire-damp, and which, by the nature of its apertures for giving admittance and exit to the air, should be rendered incapable of communicating any explosion to the external air." It is evident, therefore, he endeavoured to form a lamp which should be safe from the combined influence of the carbonic acid gas, of the azote or nitrogen gas, and of the wire-gauze.

State to the Committee in what way you think the lamp of Messrs. Upton and Roberts is an improvement on that of Sir Humphrey Davy?—There are several points of view under which we may regard it as an improvement. In the first place, it is quite evident that the wire-gauze of the common Davy-lamp partially obstructs or impedes the passage of flame through it; and, therefore, if you employ two layers of wire-gauze, the obstruction is greater than that produced by one. Now in practice two layers of gauze are objectionable; first, because such lamps would give very little light; and secondly, because the gauze soon becomes clogged up. But even if these objections could be overcome, there exists a still more weighty one, namely, that the lamp, even with a double layer of wire-gauze, is not secure. I have repeatedly passed flame through lamps of this kind; the experiment occupies a little longer time, because the flame passes less readily through two than through one; but it does pass, and therefore such a lamp is insecure. Now in Upton and Roberts's lamp only one layer of wire-gauze is employed, and therefore there is little impediment to the light. To prevent the effects of lateral currents, they use a cylinder of glass placed external to the gauze. This is one improvement over the common Davy-lamp: it must be admitted, however, that Davy, at p. 136 of his work, proposed screens to increase the security of his lamp; but neither the screens of Davy, nor the cylinder of glass employed by Upton and Roberts, would of itself be sufficient to make the lamp secure. Hence, therefore, we come to the next part of the improvement made by Upton and Roberts, and which consists in the manner they admit the external air, or the explosive mixture, to the interior of the lamp. Around the lower part of the lamp is a number of apertures, through which the air passes into a chamber, the ceiling of which consists of layers of wire-gauze. To increase the security of the lamp, any number of these layers may be employed; they are easily taken out and cleaned, and they offer no impediment to the light: whereas in Davy's lamp, any increase in the number of wire-gauzes diminishes the light. This then constitutes a most important improvement. I now pass on to another improvement in this lamp, and which in fact constitutes its superiority to all other safety-lamps that I have seen: when the air or gas has passed through the wire-gauzes, it does not pass immediately into the body of the lamp, but into a second chamber, bounded above by a conical piece of brass, having a central aperture about the size of a sixpence, in the middle of which is the wick; so that all the air passing into the lamp, is brought in contact with the wick, and thus increases the quantity of light evolved; and as the aperture is much smaller than the cavity of the wire-gauze cylinder, the latter cannot fill with flame when introduced into an explosive mixture, so that the flame can never touch the wire-gauze cylinder; and, indeed, between the flame and the cylinder there is no oxygen to support combustion, as may be shown by its extinguishing a taper, we have, therefore, the very condition Sir Humphrey Davy wanted, since no taper will burn in the space between the flame and the wire-gauze; so that you observe we have three impediments to the lateral passage of the flame, a layer of carbonic acid, a wire-gauze cylinder, and a cylinder of glass. The safety of the bottom consists in any number of wire-gauzes the maker may choose to employ, and therefore if the lamp is not safe it is his fault.

Then how is the top of the lamp secured? It is made safe by layers of wire-gauze, and also by having a contracted aperture to the glass, by which the draught is increased, and all the carbonic acid gas that is formed below, by the combustion of the fire-damp, or of the oil of the lamp, as well as the nitrogen of the atmospheric air, contribute to prevent the combustion of a body in this situation, for if you put a lighted taper here, it is extinguished immediately. Thus then this lamp is made safe at the sides, at the bottom, and at the top, by different methods. If the glass should *break, the lamp is then a common Davy-lamp.*

Have you made experiments on that lamp in the explosive mixture?—I have submitted this lamp to every experiment I have submitted the Davy-lamp to, and I could never get this to explode; indeed, I have submitted this lamp to a test (oxy-hydrogen gas) which it is not likely to be put into actual practice.

This lamp then is safe in a draught or current of explosion gas?—Yes, it is perfectly safe in any current carburetted hydrogen gas, or of this gas and oxygen, or of this gas and air. I have repeatedly tried it, and the flame will not pass. When the explosive mixture was blown in gently, the flame increased in size; if passed in with violence, the flame was extinguished, but no passage of it will take place through the gauze.

Have you made any experiments in coal mines with it?—No, I have never been in a coal mine with it. My experiments were made with coal gas and with hydrogen gas.

Experiments made before the Committee at the London University, 30th July, 1835, with the Lamps enumerated below:—

No. 1, the common Davy lamp; No. 2, ditto, with different seams; No. 3, Dr. Clanny's new lamp; No. 4, Stephenson's lamp, with glass; No. 5, ditto, improved construction of lamp, with glass (Mr. Ayres', Newcastle, lamp); No. 6, Robson's Bolton lamp; No. 7, Refrigerating lamp; No. 8, Dillon's lamp, with a shield of talc surrounding it; No. 9, Upton and Roberts's lamp.

Jonathan Pereira, Esq., further examined:

On your former examination, you were so good as to state to the Committee appointed to conduct the inquiry your views as to the relative safety and value of Sir Humphrey Davy's invention; have you a lamp on that principle before you?—I have.

Will you proceed to illustrate the views you then advanced upon that lamp?—There are three lamps present, which are made on Sir H. Davy's principle; one belonging to me, the second belonging to the Mechanics' Institution, and the third one was brought by the Chairman of your Honourable Committee. I propose, in the first place, to show the experiments mentioned by Sir Humphrey Davy, as demonstrating the security of his lamp, and then to prove, that, although a lamp may stand these tests, it may, notwithstanding, be insecure. At pages fourteen and fifteen of his book on Flame, he says, "That, in plunging a light surrounded by a cylinder of fine wire-gauze into an explosive mixture, I saw the whole cylinder become quietly and gradually filled with flame, the upper part of it soon appeared red hot; yet no explosion was produced." We will, therefore, take a cylinder, containing an explosive mixture of atmospheric air and coal gas.

If it be objected that coal gas is not identical with the fire-damp of coal mines, I beg to refer the Committee to the statement of Sir Humphrey Davy, at page 15. "Though," says he, "all the specimens of fire-damp which I had examined consisted of carburetted hydrogen, mixed with different small proportions of carbonic acid and common air, yet some phenomena that I observed in the combustion of a blower induced me to believe that small quantities of olefiant gas may be sometimes evolved in coal mines with the carburetted hydrogen. I, therefore, resolved to make all lamps safe to the test of the gas produced by the distillation of coal, which, when it has not been exposed to water, always contains olefiant gas." I presume, therefore, I am warranted in using an explosive mixture of coal gas and air. [*The lamp was then immersed in this mixture.*] You will please to observe the flame does not pass through the gauze in this experiment; and, therefore, the lamp has stood this test.

What is the estimated proportion of gas in that mixture?—About one-seventh part of coal gas. The second method, mentioned at page sixteen of Davy's work, is to place a lamp in a glass receiver, through which is made to pass a current of explosive mixture of coal gas and air. [*The experiment was tried.*] The lamp stands this test also; the gas burns inside the wire-gauze cylinder, but the flame does not extend through it.

From that do you not show that the gas becomes inflamed within the gauze, but no flame passes into the surrounding atmosphere?—Yes.

Do you apprehend that is the experiment by which Sir H. Davy meant to prove, that, in practical use in mines, a moderate current of foul air falling on the gauze would not produce explosion?—Yes; but there is a third method which he adopted to prove the security of the lamp. At pages 137 and 138, he says, he held the lamp in a blower in a mine belonging to J. G. Lambton, Esq., and he states that the result was, the lamp did not fire the gas till the gauze reached a welding heat, when the iron wire began to burn with sparks, and the explosion then passed. As we have not a mine-blower to use, I shall employ, by way of illustration, a jet of coal gas.

Will you state the chemical distinction between the gas you are now about to use, and that which you understand is found in the mines of Great Britain?—The gas found in the mines of Great Britain is said to be light carburetted hydrogen, which is composed of six parts, by weight, of carbon, and two parts, by weight, of hydrogen. Coal gas consists principally of this, but contains also other compounds of carbon and hydrogen, the nature of which varies with the temperature to which the coal is exposed, the nature of the coal, &c. In other words, coal gas is a variable mixture of different compounds of carbon and hydrogen; the principal one being the gas found in coal mines.

Do you think the gas that lights our streets is a sufficiently near approximation to prove the experiment you are about to make?—I do; I found my opinion on the statement and practice of Davy. It is evident that he considers coal gas a more delicate test for a lamp than fire-damp; but, as I have already mentioned, he thought it necessary to employ coal gas.

Will not the experiment be a test of mechanical, as well as of chemical, agency?—Certainly.

Will your experiments illustrate your theory so far as regards mechanical agency?—Certainly. I now hold in my hand Sir H. Davy's lamp. In order to show its insecurity, I purpose subjecting it to the influence of a jet of coal gas until the gauze becomes properly heated for the success of the experiment. It is evident at the present time that the flame does not pass through the wire-gauze [*here the experiment was tried*], because, as I believe, the gauze is not sufficiently hot. In the experiment made by Sir H. Davy, which I have already alluded to, I strongly suspect if he had assisted the passage of the flame by a slight motion to and fro of the lamp, the flame would have passed long before the gauze was heated to whiteness. [*Mr. Pereira having held a lamp for a short time in a jet of coal gas, tried to pass the flame through the gauze by a quick lateral motion of the lamp, but the flame did not pass.*] I attribute the failure of this experiment to the weak supply of gas, owing to the slight pressure at the gas-works. I am, however, prepared against this cause of failure, for I have a quantity of coal gas in a gasometer, to which we can apply a strong pressure, but I would prefer firing it from the common gas-pipe; and, therefore, I will try the experiment again. [*The experiment was tried, but the flame did not pass.*]

No explosion has passed in the last experiment?—No.

Do you attribute this to the gauze not being sufficiently heated?—Yes. I find it requires some time to heat the gauze. [*The experiment was tried.*] The flame has now, you observe, passed, but the gauze is not injured. Now that the gauze has become sufficiently heated, the flame will be allowed to pass readily. The experiment succeeds better at night, when there is a better supply of coal gas.

Do you observe by your eye whether there is an appearance of redness on the gauze?—I cannot observe any appearance of redness; but I do not think the eye would be a good judge under these circumstances, for the gauze might be heated to a dull redness, without being visible, owing to the strong white light of the gas within the cylinder.

Do you not apprehend it to be very important to the miner to know what state the gas is in?—Of course it is; and he would observe, by the enlargement of the flame, there was danger. [*The experiment was again tried.*] You will please to observe that the flame has passed a second time through the wire-gauze cylinder of the Davy-lamp. Let us now try the experiment with a second Davy-lamp. [*The experiment was tried, and the flame passed.*]

But, in case the lamp was placed in a foul mine, and of course surrounded by an explosive atmosphere, would not the gauze heat much more rapidly than under the circumstances of the experiment you are now performing?—Yes; and I therefore propose presently to submit this lamp to the action of a current of explosive gas. [*Mr. Pereira again attempted to pass the flame through the wire-gauze, by holding the second Davy-lamp in a jet of coal gas, but the flame did not pass; in a third experiment it did pass.*] The experiment, you will observe, will not invariably succeed; and a man, therefore, may try a lamp two or three times, and fancy that it is safe, although it may not be really so; for a lamp that will allow the explosion to pass once only in fifty trials is insecure. Having now shown on two Davy-lamps that the flame will pass when we subject a lamp to a stream of coal gas, assisted by mechanical agency, I propose to subject the Davy-lamps to another test—namely, to hold them before a jet of explosive gas, composed of coal gas and air. The apparatus before me will enable me to ignite a stream of this mixed gas without the danger of its explosion in the reservoir bladder. The proportions which we will, in the first place, try are, three measures of air to one of coal gas. The bladder containing this mixture I attach to the safety apparatus: I shall call it, by way of distinction, the reservoir bladder. I press on the bladder, and a stream of gas is forced out through this jet pipe. I now apply a lighted taper to the issuing gas, and you will observe a bluish flame is produced; the mixture of air with the coal gas very much diminishing the light evolved by the latter in combustion. I propose, then, to submit the Davy-lamp to a stream of this gas; and, when I observe the wire-gauze on the opposite side of the cylinder becomes red hot, I have only to project a little coal gas on it, and the flame immediately passes. [*The experiment was tried, and the flame passed.*]

The Committee observe that the gauze becomes red hot?—Yes.

Will you try the experiment, by forcing the coal gas against the gauze in the red hot state, after having removed the lamp from the jet of mixed gas?—The radiating power of the gauze is so great, that the cylinder cools below redness immediately upon removing the lamp from the influence of the jet of mixed gas. However, I will try the experiment. [*Mr. Pereira held the lamp before a jet of mixed gas, until the wire-gauze became red hot, and then quickly removed it to a jet of coal gas about half a yard distant; the coal gas immediately ignited.*] You will observe that the flame has passed.

You have succeeded in lighting the gas at the heated gauze?—Yes; I presume these experiments will be sufficient to prove the insecurity of the Davy-lamp.

Do you not make any allowance for the very rare cases in which the lamp can be tested in practice in the way you have now tested it; I mean in moving it forcibly through the atmosphere, dispersing the whole of the carbonic acid gas, and bringing it back to the jet, with an explosive mixture filling the gauze?—I apprehend the question to be, how far my experiment is analogous to the circumstances met with in coal mines. In coal mines the miner's lamp is sometimes exposed to immense quantities of gas, and to powerful blowers. I presume, therefore, if I can cause the flame to pass through the wire-gauze cylinder by means of a small jet of gas like this, that the passage of the flame will take place more readily in coal mines. If the miner move his lamp, the danger is increased. A current or motion of the gas by a fall of water may endanger the lamp.

Can you explode the Davy-lamp by a mixture of carburetted hydrogen and atmospheric air, by merely plunging a lamp suddenly from the common atmosphere into such mixture?—I have never been able to do it; but the quantity of mixed gas which I have experimented with is so small, compared with that found in mines, that I can readily believe explosions may occur in mines which we cannot produce on the small scale. I have frequently tried the experiment, but never produced the passage of the flame; owing in part, as I conceive, to the presence of the carbonic acid, which is produced by the combustion of the gas within the cylinder. However, there is a gentleman in this room who asserts that he can pass the flame under these circumstances. If you please, therefore, we will try the experiment. We have here an explosive mixture of six parts atmospheric air, and one part coal gas; and I propose, therefore, to fill this large cylindrical vessel with it, and then plunge the lamp in. [*The experiment was tried.*]

The flame has not passed?—No.

Do you apprehend if that lamp had been moved quickly through an atmosphere, combining the proportions you have just exhibited, that any explosion would have taken place?—I think it possible that the flame might pass through the gauze, if the lamp were suddenly introduced into a large accumulation of explosive gas, such as is sometimes met with in coal-mines, though the flame will not pass when the lamp is placed in the very small portions of gas which we can subject it to.

Are you not aware that the proportions of air and inflammable gas in mines vary materially, according to the analyses of different individuals?—The following are the results of some analyses of fire-damp made by different chemists:—

Dr. Henry's Analysis.

Atmospheric air	63·34
Carbonic acid	1·66
Inflammable gas	35·00
	100·00

Dr. Thomson's Analysis.

Atmospheric air	32·00
Carbonic acid	5·00
Inflammable gas	63·00
	100·00

Sir H. Davy's Analysis.

	Purest.	Most Impure.
Atmospheric air	6·66	41·66
Inflammable gas	93·33	58·33
	99·99	99·99

In some cases azote and carbonic acid were present.

Are these quantities said to have been taken from mines?—Yes, from coal-mines.

Is there any means of ascertaining the velocity at which the jet moves?—It could be done, but I have not the means of doing it now.

Can you form a rough estimate of it?—No.

Can you suppose, from what you have heard of the state of the mines, the jet of gas having the same velocity there?—I should think a much greater velocity. I have heard of doors *being blown down* by the sudden *escape of gas.*

Have you heard of any instance where there was no ignition?—I have heard from Mr. Roberts, that fire-damp has sometimes rushed out (from a sudden fall of coal) with such force that it has blown down doors.

Do you consider that the Davy-lamps you have tried are perfect?—Yes. One of the lamps brought by the Chairman of your Honourable Committee is a new lamp. The wire-gauze of which the cylinders are made appears to me, by comparison with some standard gauzes before me, to have at least 900 apertures to the square; and Mr. Roberts, a lamp-maker, tells me, that this Davy-lamp which I have exploded has 1,024 apertures. At pages 44 and 45 of his work on Flame, Sir H. Davy says, a wire-gauze having 576 apertures to the square inch is safe, under all circumstances. At p. 41, he says, gauze with 625 apertures is safe; and at p. 16 he says, one with 784 apertures is safe. I have tried lamps with much finer wire-gauze cylinders than those used to-day, and have found the flame readily passes. If two wire-gauze cylinders be employed, the experiment occupies a little more time, but the flame readily passes.

Do you consider those experiments to have proved satisfactorily that the Davy-lamps are not what they profess to be, safety-lamps?—Yes. I beg to mention, in corroboration of this opinion, that a year or two since I inspected the gas-works at Westminster, and the man who was sent round with me showed me the safety-lamps used there, and which were made on Davy's principle. On asking him whether they ever allowed the flame to pass through them, he replied, that twice he had fired jets of gas by them. The circumstances under which this took place he stated to be as follows:—he was accustomed to examine the condition of the gasometers every night, and twice in walking round them with a Davy-lamp in his hand he had fired a jet of gas issuing from an aperture in the gasometer. On mentioning the circumstance, he stated he had been blamed for having used an imperfect lamp, but he could not discover any imperfection in it.

I believe you have a lamp before you, which, in addition to the gauze, has a glass cylinder inside?—Yes, there are several of these on the table. Here is one of Stephenson's lamps, which is marked No. 4.

In what particular does that lamp vary in its construction from the lamp you have just been using? Is the air admitted from below?—The air seems to be admitted beneath this rim at the lower part. This lamp is locked, and therefore I cannot light the lamp to try it; but here is another, of the same kind and make, which is not locked.

Is the air admitted in precisely the same way?—Yes, as far as I can judge.

I believe that is a lamp, the principle of which was known prior to the invention of Davy's; are you aware whether that is a fact or not?—I am not aware.

Does not the difference consist in the air being admitted from below, and no air being allowed to pass to the gas in consequence of the glass lens inside?—The air is made to pass by some apertures beneath this small brass rim, and then through a number of small apertures in a copper or brass plate.

Will you now proceed to try whether you can cause an explosion from that lamp?—I will.

Do you apprehend it is possible to cause an explosion of that lamp in a mixture of atmospheric air and carburetted hydrogen?—I have not yet tried the experiment. Before I proceed to try any of the lamps now present, I beg to state to this Honourable Committee, that I think a higher test of the security of the lamps should be used than merely coal-gas and air. The reasons that lead me to this conclusion why a higher test should be taken, are the following:—In the first place, a lamp is placed in a more dangerous position in a coal-mine, from the presence of immense quantities of fire-damp, and which we cannot imitate here; secondly, the inflammable part of fire-damp may possibly, nay, probably does, vary. Although Henry Thomson, and Davy, all agree that the inflammable gas was light carburetted hydrogen, yet certain reasons lead us to suspect there may occasionally be some variation. At p. 15 of his work on Flame, Davy states that some phenomena led him to believe olefiant gas was sometimes evolved; and at p. 144, he even admits the possibility of hydrogen being present, though he thinks it improbable. Mr. Goldsworthy Gurney, who is now present, tells me that he discovered pure hydrogen in a Welsh coal-mine. That there is a considerable variation in the quality of the inflammable gas of coal-mines, I have long thought probable, from the statements made by some intelligent, practical miners: an opinion which is much strengthened by a knowledge of the variable nature of the gaseous products obtained by the distillation of coal. Taking, therefore, all those circumstances into consideration, I think the most prudent and safe course is to submit the lamps to a much higher test than coal-gas and air; but if, unfortunately, no lamp can be found which will stand this test, we must try them by some lower test. The test I propose is, to expose the lamps to a stream of inflammable gas composed of three or four parts, by measure, of hydrogen gas, and one part, by measure, of coal-gas. I think we may fairly presume that a lamp which will *stand this test will be safe,* under any circumstances, *in a coal-mine.* I do not mean to say that a lamp that will not stand this test is necessarily insecure in a coal-mine, but it is better to use a lamp which we know is secure, under all possible circumstances, than one of which we are doubtful. Having made these preliminary remarks, I propose, with the approbation of your Honourable Committee, to subject all the lamps now before me to this test. The first lamp which I will try is Stephenson's. We will expose it to a stream of gas composed of four measures of hydrogen and one of coal-gas. [*The experiment was tried; the flame of the lamp was blown out, but no explosion took place.*] You will observe the flame has not passed; but owing to my having propelled the gas into the lamp with too much force, the flame is extinguished; I shall, therefore, repeat the experiment, employing much less force. [*The experiment was repeated on Stephenson's lamp, and the flame passed.*]

You have applied the mixture of which you have just spoken, and the lamp exploded downward; the gas so applied exploded downward?—Yes.

Through the small orifices at the base of the lamp?—Yes; through the apertures by which the atmospheric air is usually admitted to the lamp. I will repeat the experiment. [*The experiment was performed, but the flame was blown out. It was repeated, and the flame instantly passed through the lamp, and lighted the jet of gas outside.*] You will observe, then, that Stephenson's lamp will not stand this test. Let us now see whether the Davy-lamp is more or less secure than Stephenson's. We should, however, expect that as the Davy-lamp is insecure, even to coal gas, it is still more unsafe to coal gas when mixed with four times its volume of hydrogen. [*The experiment was tried on a Davy-lamp; after three trials the flame passed through the wire-gauze cylinder.*] You will observe I had more trouble to pass the flame through Davy's than through Stephenson's lamp. The next lamp which I will examine is that made by Mr. Dillon, and which is marked No. 8. It has much the same structure as the Davy-lamp, but the cylinder is longer; there are three wicks, and it is covered externally by a shield of mica, as recommended by Davy at page 136 of his work on Flame. [*The experiment was tried, and the flame instantly passed.*] No sooner was the stream of gas (hydrogen and coal gas) thrown on the gauze, than the flame passed through.

Of course if the jet came in the direction of the shield, it could have no effect?—No. But as the jet of gas which I employ is very small in comparison with some blowers in coal mines, I therefore direct it a little upwards; for when the lamp is exposed to a large blower, some of the gas must pass up the cylinder, by the current generated by the combustion in the lamp. [*The experiment was repeated.*] The flame has passed a second time.

Have you tested all the lamps?—No; I have only tried the lamps of Davy, Stephenson, and Dillon.

Proceed to test all the lamps with the high test?—Here is a lamp marked No. 7.

It is a mixture of Stephenson's and Davy's principle, improved by Wood of Killingworth. Is that lamp known by the name of the Refrigerating Lamp?—Yes.

Is not the upper chamber surrounded by water, to prevent the heated gas passing off at the top of the lamp?—I have never examined it before, but I presume this cavity is to hold water. I am sure that the flame will instantly pass, though I have never tried the experiment.

You are aware that the water in the upper part of the lamp will prevent the passage of the flame there?—Yes; but there is lower gauze which is not protected by water. This is the most vulnerable part of the lamp, and therefore the one which I shall subject to the influence of the stream of gas.

It is not intended to stand against the experimentes you are about to perform, but merely as a protection to the upper part of the lamp?—It should be a protection to the lower part, otherwise the lamp is not safe. As the refrigerating lamp is not yet prepared for the experiment, we will try Mr. Robson's lamp, marked No. 6. This lamp, also, I have never tried before. [*The experiment was tried.*] The flame passes instantly downward. Mr. Robson's lamp explodes with the gas, and is therefore insecure.

Dr. Clanny, examined :

Have you any objection, or do you see any reason, why your lamp, which is known as your improved lamp, should be subjected to the experiment of the highest test which has been already tried on other lamps?—It has been submitted to a current of inflammable air, both in coal mines and also in my laboratory.

Do you, Dr. Clanny, apprehend, from what you have seen in the mines yourself, that you would be likely in the mines of Durham to meet with a gas which would constitute so high a test as what we are now applying?—It is a subject which I have not heretofore entertained. But if this Honournourable Committee requires it, I will go into the most inflammable mines in the counties of Durham or Northumberland at any future day.

But, Dr. Clanny, if your lamp should explode with the mixture which has been produced, you would not at all attempt to deny, *that it would be exceedingly* dangerous to do so; if you could suppose a similar combination existing in mines, subject to an equal mechanical pressure?—The principle of this is simply that the moment the inflammable air is admitted to it, the shield descends; the piece of wire is fused, and the shield descends, so as to isolate it in respect of the surrounding atmosphere.

Are you not speaking of the combinations which you know to exist in the mines around your residence?—Precisely.

You do not allude to the combination of gas now produced to the Committee?—I do not; upon that point I have not considered the subject; nor do I consider at all whether it would be proper to try it with pure hydrogen, as we call it; in this instance I have no objection to the trial.

While you admit the fairness of the experiment, your conviction is that it is not an experiment which can be practically performed in mines?—I am not aware that there is any pure hydrogen in mines; I never found any pure hydrogen in mines; but I have been impressed with the idea that there is olefiant gas in mines, but to what extent I cannot say.

Mr. Pereira's examination resumed :

What lamp are you going to make the experiment on now?—I will now take the water lamp, or the refrigerating lamp. [*The experiment was then made.*] The flame passes directly. [*The experiment was repeated.*] It has again passed it, but not so easily as the first time, probably because there is a little carbonic acid in the cylinder. [*The experiment was again tried.*] Again you observe the passage of the flame through the apertures of the lower part of the lamp.

Have you got the lamp before you on the principle of Dr. Clanny?—Yes.

Are you aware of the principle on which that lamp is proposed to act; the external shield being supported by a small wire across the gauze, immediately the wire is fused by the burning of the explosive mixture in the inside, the shield will descend?—Yes, and upon that principle it is called a safety-lamp; I had heard of it, but never saw it till to-day.

Will you please to proceed to place the lamp burning (Dr. Clanny's) in such a composition as you presume, from what you have heard, is ordinarily found in mines in an explosive state?—With the permission of this Committee, I will first subject this lamp to the same mixture which I have tried on the other lamps, namely, four measures hydrogen and one coal gas. [*The experiment was tried; the flame instantly passed.*]

Can you plunge Dr. Clanny's lamp into a receiver full of gas, so as to support combustion for a few seconds without firing the gas?—I do not doubt it; Davy's lamp will do that.

What the Committee wish to know is, whether the mechanical contrivance of the shield will act?—[*Dr. Clanny, on examining his lamp, objected to any further experiments being performed on it, on the ground that the lamp had not been properly prepared for the experiment.*]

Dr. Clanny re-examined:

Are the Committee to understand that you object to any experiments being proceeded with on the present occasion as to your lamp, owing to your lamp not being properly trimmed, or satisfactorily prepared for the experiment?—Certainly.

Mr. Pereira's examination resumed:

Will you now proceed with the high test to try Messrs. Upton and Roberts's lamp?—I will. [*The experiment was tried.*] The flame does not pass in this position, but I will try the lamp in another. [*The experiment was again tried on Messrs. Upton and Roberts's lamp.*] I have again exposed this lamp to a jet of hydrogen and coal-gas, but the flame has not passed.

Is not the gas in the bladder nearly exhausted from the effect of the experiments previously made?—There is quite sufficient left. [*The experiment was repeated.*] The flame of the lamp is now blown out, in consequence of my propelling the gas into the lamp with violence. [*The lamp having been re-lighted, was again exposed to the jet of four measures of hydrogen and one of coal gas, but the flame did not pass.*] To prove that the gas I am now using is a high test, let us take Stephenson's lamp and hold it in the jet of the gas. [*The experiment was tried.*] You observe the flame instantly passes; but when I apply the same gas to Upton and Roberts's lamp, slight detonations occur within the lamp, but the flame does not pass; and if we now increase the force with which the gas is propelled in, the lamp is extinguished. [*Experiment performed.*]

What would be the consequence provided the whole body of the lamp was filled with the same gas; would it explode at the top?—This lamp is so constructed that it cannot fill with inflammable gas.

Do you mean to say it would explode before it got fully charged?—Certainly; the gas would burn as it passed into the lamp, and the supply being limited, the wire-gauze cannot be filled with flame.

Is there a double wire-gauze at the bottom of the lamp, to prevent the passage of the flame?—Yes.

Can you immerse that lamp in a volume of mixed gas, or coal gas and air?—Yes; one part of coal gas, and three parts of air *is the mixture which I am now about to employ.*

Will you immerse Messrs. Upton and Roberts's lamp slowly in that mixture?—[*The experiment was tried.*]—The lamp is extinguished, but the flame has not passed. I will now use a more explosive mixture, namely, six of air and one of coal gas.

Let the lamp be slowly immersed in that mixture. [*The experiment was tried, and it did not explode.*]

Have you ever tried what the result would be in case a lamp, with the gauze perfectly cold, was placed in an explosive mixture?—The experiment cannot be made with a cylinder quite cold; for in the act of putting on the cylinder after lighting the lamp, the gauze becomes slightly warmed. I have performed the experiment as quickly as I could, and with a wire-gauze cylinder as cold as we could obtain it, but I have never made the flame pass by immersing the Davy or Upton and Roberts's lamp in any mixture of coal gas and air. I have tried the experiment frequently, and have considered it with a good deal of attention, understanding an opposite opinion was entertained by Mr. Dillon. I believe that the colder the wire-gauze, the safer the lamp; whereas Mr. Dillon thinks the safety of the lamp consists in the cylinder being hot. Every experiment that I have made is against his opinion.

Mr. Dillon examined:

Have you performed the experiment which has just been named by Mr. Pereira?—Yes, I have.

What was the result?—An explosion from the inside of the lamp, if the lamp was cold; but if it is allowed to burn for a short time, the caloric in the meshes of the wire-gauze prevents the explosion from extending to the outside of the lamp.

Mr. Pereira's examination resumed:

Does that agree with your theory, Mr. Pereira?—No. I should like to see Mr. Dillon perform the experiment, for I have never been able to get the result stated.

Mr. Dillon re-examined:

Do you object to try the experiment in the presence of the Committee?—No.

Do you attach any importance to the precise mixture of gases?—No. I propose to try it with four parts of air and one of coal gas. For the purpose of establishing my theory, the gas which will most easily explode should be tried. I have frequently done it with hydrogen, which establishes the theory; the explosion takes place outside and inside; if the lamp is hot, the explosion takes place inside. Mr. Pereira may try the experiment before the Committee with hydrogen gas, and it will establish the principle I have laid down.

Have you any objection to repeat the experiment by which you stated you procured the explosion by immersion of the lamp, as cold as it can be, in the proportion of gas already named; namely, four to one?--Yes, I will; but the lamp is not perfectly cold. I wish you would try the experiment upon hydrogen, which will establish the theory.

Mr. Pereira's examination resumed :

Mr. Pereira, the way the Committee understand Mr. Dillon wishes you to proceed is, that the instant the lamp is lighted you should secure the gauze on the lamp, and then immerse it in the gas with as little delay as possible. [*The experiment was performed on a lamp belonging to Dr. Turner, which had not previously been lighted; the explosion did not take place.*]

Do you propose to make any other experiments on Upton and Roberts's lamp?—There is one other gas that is still more severe, oxygen and hydrogen, but it is not likely to be met with in mines.

Could you immerse Upton and Roberts's lamp in pure hydrogen?—It will go out in pure hydrogen, from the want of oxygen. I will submit the lamp to four parts of air and one of hydrogen gas, without any coal gas. [*The experiment was tried.*] It will not explode.

What proportions are you now about to use?—About one-third hydrogen and two-thirds atmospheric air. [*The experiment was tried and the lamp was immediately extinguished.*]

Then is the result of your experiments that you cannot assume any contingency in mines in which Upton and Roberts's lamp would be liable to explosion?—As long as the lamp is a perfect lamp, (that is, uninjured in its parts,) I believe it to be quite safe.

Of course the safety must entirely depend on the glass being unbroken?—Yes.

If the glass break, it becomes really a Davy-lamp?—Yes.

Mr. Dillon re-examined:

The lamp which you have produced, you consider improved to the extent to which the shield operates with respect to the current coming in at the shield?—Yes, I do; I consider that in any coal mine my lamp is a perfect security, the shield of talc is a perfect security.

John Murray, Esq., Lecturer on Chemistry, examined:—

Do you, as a scientific man, consider Sir Humphrey Davy's lamp to be emphatically a safety lamp in all cases?—No, I certainly do not.

Will you give the Committee your opinion on that subject, as the result of experiment or theory?—As the result, I should say, of direct experiment. I have no doubt that very many accidents have occurred with Sir Humphrey Davy's lamp, that lamp not being absolutely safe, igniting an explosive atmosphere. Of course I do not wish to enter into the theory, for I happen to differ with scientific men generally, and I would rather confine myself, if you please, to practical results. The accidents from the lamp, I conceive, are in the first place to be ascribed to the mere occasional use of the lamp. Taking it, for instance, as an exploring lamp, and suddenly encountering an explosive atmosphere, or perhaps passing a blower, the sudden entrance of an explosive atmosphere into the lamp would ignite it almost immediately, and I should think kindle the gas; in my experiments it has kindled the gas, by making the lighted lamp to transmit, for instance, a jet of carburetted hydrogen; for it has passed through the lamp and ignited the gas at the orifice. There is another cause of accident with that lamp, which has not been alluded to; the indiscriminate use of copper and iron-wire gauze. I was the first who made the experiment which proved the danger of the copper safety lamp. I made the experiment with the fire damp in the Bagilt colliery in North Wales. The fire-damp burned green, and possessed the green tint which it received by the solution of copper. The explosive flame was in actual contact with the copper tissue, which when dissolved in the fire-damp, communicated a green tint to the flame within; a sufficient proof that the copper was dissolved.

Did you continue that experiment sufficiently long to ascertain what length of time would be required to oxydize the whole substance?—No; I did not continue it sufficiently long, but I am in the habit of repeating it for illustration. I suppose I have made the experiment more than 100 times; and to prove it, we have only to immerse slowly a copper safety lamp in a portion of the vapour of ether mingled with atmospheric air, and will then find the whole cage full of a green-tinted flame; and, moreover, that the flame is in evident contact with the wire-gauze itself.

Now, will you turn your attention to the iron-wire gauze?—With regard to the iron-wire gauze I differ in opinion as to the cooling influence to which it has been ascribed, because I believe the lamp is dangerous when it is cool.

Perhaps you will give the Committee your idea of the rationale of Sir Humphrey

Davy's lamp as explained by himself?—Flame in all cases whatever is to be considered as inflammable vapour or gaseous inflammable matter, heated above whiteness. The lamp simply acts by cooling that incandescent inflammable matter below the point at which it is incandescent, when it ceases to be flame. This is said to be a very simple explanation, but the question is, whether that explanation be correct.

Now, will you compare that view of the case with the one you have been led yourself to form?—The way that I explain the lamp is this, and I am warranted in my conclusions by the experiments of Mr. Dillon of Belfast, irrespective of my own. Indeed I constructed a safety-lamp proving the fact I am about to state. It may be mentioned that the fire-damp of the mine, when it forms from one-seventh to one-thirteenth part of the atmosphere, will explode, though beyond these limits it will not explode. If we mix a small portion of either azote or carbonic acid gas with such a mixture, it will no longer explode, or it will disarm it of explosion. I need not mention that the more highly concentrated an explosive atmosphere is made by condensation, the more violent will be its explosive effect when it is ignited. Now it occurs to me that, seeing the lamp is positively safe when it is heated, though unsafe when it is cold, the heated wire-gauze which confines the explosive flame within will enfeeble its power by attenuation, because if we attenuate or rarefy such a mixture, whether by the air-pump or by heat, it will not explode. I cannot see how any cooling influence could operate where individuals have worked for many hours with the lamp red hot, and I have myself had the lamp red hot from top to bottom, yet remaining safe. I have gone through an explosive atmosphere in a colliery in the neighbourhood of Paisley; I cannot therefore discover wherein the cooling influence of red-hot gauze resides.

Can you point out any simple improvement, such as would be likely to be adopted in the construction of the safety lamp, which may have suggested itself to you in the course of the numerous experiments which you appear to have made?—I would have not merely a semi-circular shield of talc attached, in the manner of Mr. Dillon of Belfast, but an entire cylinder, but would carry it only to a certain extent of the wire gauze.

Is that less fragile than glass?—In the case of using it as an exploring lamp, that would prevent the impulsion of the flame against the opposite side in traversing the galleries.

(To be continued.)

NEW ENGLISH, SCOTCH, AND IRISH PATENTS.

Brief Abstracts of Specifications, with Remarks.*

John Losh, *of Carlisle.*—"An Improvement in the Surface or Pattern-Roll of the Machines used in Printing Calico and other Goods, commonly called a Surface Printing-Machine, and in the Mode of Working the said Rolls."—Patent dated 30th May; Specification enrolled 13th November, 1835.

The "improvement in the surface or pattern-roll" (cylinder engraved in relief) consists in adding a raised rim to each end of the roll. When the figure of the pattern is small, the rims are to be formed of thin copper rods, but when large and wide they are to consist of parts of the roller left in bolder relief than the rest. The object of this improvement is not stated, but it may be either to enable the workman to apply the cloth to the roller with greater exactness (serving a similar purpose to the wire points of the old printing-blocks), or to prevent the raised parts of the cylinder from making too strong an impression. The improvement in "the mode of working the said rolls" consists in dispensing with the present toothed-wheel and pinion, and forming one end of the roller outside the pattern into a drum, and making it rotate by a band passed over it. The patentee states, that whenever it happens that the toothed-wheel is not of exactly the same diameter as the pattern-roll, a sort of dragging action takes place, which causes the roll to give off a confused and smeared impression. As the drum now proposed to be substituted may be turned true with the surface of the pattern at the same time that the latter is dressed in the lathe, the greatest possible coincidence between them is thus ensured. At present, moreover, when the parts in relief are worn by constant working, or when the roller shrinks from the heat to which it is exposed, it is necessary to throw it altogether aside; but by making the roller and the drum by which it is made to revolve, in one, the pattern can be redressed at pleasure and the drum be also turned anew to coincide with it.

Both improvements—the latter especially—have the merit of considerable practical utility, if not of much mechanical originality, and were deserving of a more scholar-like introduction into the world than it has been their good fortune to obtain. The same ignorant hand which has made such an ungrammatical mess of the title, seems to have been hard at work on the specification. The whole process of making the rollers for surface-printing is described, though it is neither claimed as a part of the patented, nor disclaimed as "old and well-known" (as it ought to have been), and has, in fact, nothing to do with the subject-matter of the patent.

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* To be continued regularly in future.

JOSEPH NYE, *of St. Andrew's-road, Southwark*.—"Improvements in Pumps and Instruments or apparatus for conveying Fluids into, and withdrawing them from, Cavities of Human and other Animal Bodies."—Patent dated 2nd June; Specification enrolled 2nd December, 1835.

The circumlocutory delicacy shown by this patentee in designating his "improvements" is, at least, as remarkable as any ingenuity displayed in them. His invention is simply an improved stomach injecting and evacuating apparatus; but afraid, it would seem, that the public might not *stomach* so plain a description of a plain thing, or apprehensive, perhaps, that human nature might feel its dignity offended by the assumption that a stomach was a thing alike common to men and beasts, he describes it as an improved instrument for "conveying fluids into, and withdrawing them from, cavities of human and other animal bodies!!" Mr. Joseph Nye must be a nice fellow; or if his title is not of his own framing, it must have been concocted for him by some still nicer old personage of the feminine gender. But that the law has been lately so *improved* that no patentee can commit any blunder so egregious that it may not be remedied, we might have expected to see Mr. Joseph Nye well punished for his fastidious pains. The *stomach* is neither in man nor beast a *cavity*—not even when empty has it any better claim to this appellation of a *cavity* than an empty sack or purse; and least of all can it be called a cavity, when those occasions arise which require an injecting and evacuating apparatus to be applied to it. Stomachs, moreover, do sometimes eject other matters than fluids, though, according to Mr. Nye's title, his apparatus can be applied to the withdrawing of "fluids" only. In Lord *Ellenborough's or Lord Tenterden's* time, *these discrepancies* would have proved fatal to the patent, and not unfairly so, for all misdescription and mystification are, more or less, frauds on the public, which is entitled to the clearest possible description of every invention, in return for the temporary monopoly of it conferred on the inventor. As it is, under the new law, the sooner Mr. Joseph Nye files a memorandum of (entire) alteration the better; for were he to go to trial on his patent as it stands, he would most assuredly be nonsuited. In a mechanical point of view, there is nothing particularly worth notice in his improvements. Instead of tubes of caoutchouc, leather, and other similar materials, which are stated to be very liable to decay in hot climates, he proposes to make use of a series of short metallic tubes, connected together by ball and socket joints.

RICHARD PHILLIPS, *of the New Kent-road, Chemist*.—"Certain Improvements in the Process of Manufacturing Sulphate of Soda."—Patent dated 4th June; Specification enrolled 4th December, 1835.

Mr. Phillips proposes to employ sulphate of iron, commonly called iron pyrites, in the manufacture of sulphate of soda, and he describes a method of doing so; but his claim is to the employment of iron pyrites for this purpose, "in whatever way the same may be turned to such use." We do not think so general a claim as this could be sustained. It resolves itself into an exclusive appropriation to the patentee's use of a certain property in nature, to which he can have no better title than any body else. We apprehend that the particular process described by Mr. Phillips is all that a court of law would allow him.

JAMES LEMAN, *of Lincoln's-Inn-fields*.—"Making, Mixing, Compounding, Improving, or Altering Soap."—Being a Communication from a Foreigner residing abroad.—Patent dated 4th June; Specification enrolled 1st December, 1835.

We have seldom met with a more absurd title than this. It is worse even than Joseph Nye's. What are we to understand by a patent for "improving or altering soap?" Is nobody but Mr. James Leman to be at liberty, for fourteen years to come, to devise or practise any improvement or alteration in the manufacture of soap? It is scarcely necessary to say, that such a patent is good for nothing. Even as limited by the specification, it is a most nugatory affair. The right which Mr. J. Leman claims to have acquired by "a communication from abroad" is an exclusive right to the manufacture and sale of all sorts of chlorated soap, that is, of all soap in which there is any mixture of chlorine! Mr. Leman is in the same case with Mr. Phillips. He may have a right to the exclusive use of any method of his own invention of making chlorated soap, but he is *all* "abroad" in claiming a right to the chlorine *per se*.

James Mitchell, *of Truro, Cornwall*.—"Improvement in the Process of Smelting Argentiferous Ores."—Sealed 22d June; Specification enrolled 22d December, 1835.

The patentee claims as his invention the process of submitting successive charges of argentiferous ores, free, or nearly free, from sulphur and arsenic, to fusion, by means of the sulphuret produced from the previous or first charge; whether such sulphuret be produced by the addition of sulphur or iron pyrites, or from sulphur contained in the argentiferous ores themselves. The patentee describes the processes of smelting according to his invention at some length, and with considerable perspicuity. He does not, however, state the advantages which his system has over the processes in common use.

William Crofts, *of New Radford, Machine-maker*.—For "certain Improvements in certain Machinery for making Figured or Ornamented Bobbin-Net, or what is commonly called Ornamented Bobbin-Net Lace; part of which Improvements are Extensions of certain Improvements for which Letters Patent have been granted to him, bearing date the 27th day of May, 1834."—Patent dated 26th June; Specification enrolled 26th December, 1835.

The world has heard of "monster" bombs and "monster" processes; it now falls to our lot to present it with a new subject for amazement in a "monster" specification. Any thing so monstrous in the patent way as this specification of Mr. Crofts', certainly never came under our observation before. It occupies no less than 65 skins of parchment; and is accompanied by 49 sheets of drawings of most complicated machinery! The stamps alone cost 117*l*. The folios being in number 1,168, a copy, at the *office-charge* of 8*d*. per folio, would cost an applicant 38*l*. 18*s*. 8*d*., besides, at *least*, 100*l*. for a copy of the drawings; and it is to be observed, that a copy of part of a specification cannot be obtained—the whole must be taken, or none.

The specification, which is said to have been drawn by Mr. Farey, is for improvements in bobbin-net machinery by Mr. Crofts, the well-known and ingenious superintendent of the extensive works of Messrs. Fishers. It is only one of many patents taken out or bought by that wealthy and enterprising firm. Deferring till our next the observations we shall have to make on it as a remarkable exemplification of the evils arising from the present state of the Patent Laws, we shall content ourselves, for the present, with giving some account of the inventions patented (for there are nine in all included in the patent), and of the specification itself, in a technical point of view.

The *first* invention of the nine is a mode of interspersing patches of clothwork in the transparent texture of bobbin-net. To this end the bobbin-threads are diverted from their usual diagonal courses, and made to run parallel with the warp-threads; the whole equally interspaced together, form the warp of the clothwork, the weft being supplied from an extra beam, and worked with extra guides and guide-bars. Mr. Crofts' claim is for effecting the above purpose on the pusher-machine—the application of the plan to the levers, to rotary and other circular machines, and to a single-tier, inverted circular, bolt machine, having been patented before.

The *second* is one for spotting the net by slackening the *carriage*-threads where the spot is intended to be, and lapping them over the right and left warp-threads often enough to form a spot of the necessary magnitude. Pieces called in the patent "forks," and which are much like pushers, are affixed to bars in front and rear of the machine, and are at proper times brought to present their ends to the carriage-threads concerned a little above the tops of the carriages, and stop them a little before the carriage has completed its motion; so that in completing its motion the carriage draws the necessary quantity of thread off the bobbin. The warp-threads round which these slackened carriage-threads are lapped are threaded through guides on extra bars; and before the carriages enter the warp-threads again, these extra bars are racked so that the slackened carriage-threads are lapped round them. The rest of the machine and threads standing still, an opportunity is given to take up with the points as often as is necessary to gather the slackened threads in quantities sufficient to form the spot, without deranging the meshes of the plain net or the twists already on. As the spots are arranged in diagonal lines, i tis necessary that there be two pairs of extra guide-bars and of fork-bars, one of which places the spots in the longitudinal spaces left vacant by the other. This article describes the application of the plan to circular machines generally, giving preference to the fluted-roller machine, and using it to exemplify the action of the contrivance.

The *third* article of the specification applies the same invention to the levers' machine; and the *fourth* to the pusher-machine. It will be observed, that in all these cases the production of plain net is discontinued while the spots are made.

The *fifth* article is for effecting the same kind of spotting by slackening carriage-threads on the single-bladed-locker rotary-machine. The contrivance is, however, different in this case. When the spotting begins, the driving-bars are lifted up quite above the tops of the carriages, and are there lodged in certain fixed standards, while the carriages concerned are passed through and through the warp-threads by pushers on an extra bar; which pushers during the ordinary working of the machine lie under the driving-bars with their ends a little retired within the edges of them, so as not to interfere with the working of the machine while making plain net. The driving-bars are lodged at such a height and width as to stop the carriage-threads as the forks do, described in the second article; the remaining observations of that article apply also to this contrivance. In this plan, also, the making of plain net is interrupted by the spotting process.

The *sixth* article contains a plan for spotting on the pusher-machine, by slackening *warp*-threads. The warp-threads concerned in spotting are supplied from an extra beam; their tension being relaxed, when necessary, by a small rotary movement of the beam. The warp-threads, which are threaded on the extra bars in this as in the former articles, perform the duties of ordinary warp-threads, *when spotting is not going on.* The carriage-threads, which meet where each spot is placed, take a return traverse, instead of a direct one, as in the case of oilet-holing: by this means is gained the tension of carriage-threads, necessary to hold out the successive lappings of the warp-threads, and thus display the spot. The spot is, in fact, a oilet-hole, with a warp-thread passed across and across it. This mode of spotting does not interrupt the making of plain net.

The *seventh* and *eighth* articles are for making spots in that kind of net (of which there are several sorts) which has no threads, that completely traverse the piece. The spot is made by successive laps of slackened warp-threads round adjacent carriage-threads. This method is applied in each article respectively to the levers and circular-bolt machine.

The *ninth* article is for substituting combs for bolts in the three-bolt-bar machine already patented. Many of our lace-making readers may, perhaps, not know that this is a machine in which the guide bars are separated far enough to allow a third bolt bar to be placed between them.

We have thus given, as near as we can from memory, an account of the inventions described in this notable specification: we say "as near as we can from memory," for the rules of the office allow no notes whatever to be taken.

The length of this specification has attracted much attention in the offices; it arises partly from the extreme complexity of the inventions and of the machinery to which they are applied; partly from the extraordinary number of contrivances covered by this one patent; and partly from the excessive minuteness of detail and amplitude of description which Mr. Farey has thought, and usually thinks, necessary to employ.

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PRINCIPLES OF RAILWAY TRANSIT.

Sir,—I have but recently had an opportunity of reading some of the later Numbers of your interesting Magazine, in which my attention was attracted to some articles on the subject of friction on railways by your ingenious correspondent, X. Y. Z. I now hasten to reply to a question he put to me in one of those articles. He asks, in reference to an observation made in a paper of mine, "Are not the opposing forces equal when a train of carriages are moving with a velocity of 30 miles an hour?" The ambiguity in the observation will be cleared up, and the truth of the remark made obvious, by referring to the line of argument made use of by Mr Whitehead and Mr. Stephenson, and, in general, all Mr. Badnall's opponents on this particular point. The question is answered thus:—Either those opposing forces are equal when the trains are moving with the above velocity, or they are not. If the latter, the question is answered; if the former, then do we get a velocity of 30 miles an hour gratuitously, and without any expenditure of locomotive-power, on the horizontal line. But if such be the fact, then we will not allow Mr. Badnall's opponents, in reasoning on the undulating line, to say, that as friction and locomotive power are equal, we are bound to assume that there is no friction on that line; if they will not wave the matter of friction on our line, (why should they?) neither will it be dispensed with on the undulating line; and when we have a velocity of thirty miles an hour, gratuitously on the latter, we well know how to add to that velocity the increased velocity obtained by means of inclined planes. So that, independent of the nice question your correspondent has raised (and I have no doubt but he is correct in his views), the mathematical investigation can be satisfactorily decided on the old theory of friction. This question of friction has caused such a diversity of opinion among eminent mathematical characters, that a proper experimental and theoretical investigation cannot possibly be much longer delayed, particularly when the question is of so much importance. I conceive the error in the theory heretofore has been, that the friction of a heavy body in motion is calculated on the same principles as that of a lighter body; and that if the friction of these two bodies be equal, that is, be measured by the same weight, although one of the bodies weigh one ton, and the other but one pound, every other circumstance connected with the motion of these bodies, as far as friction is the subject matter in question, will be equal; which will no doubt be found an erroneous doctrine.

I remain, Sir, &c.,

MENTOR.

MR. MACKINTOSH'S ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—I read with great pleasure, in No. 645 of your valuable Magazine, Mr. Thomas Macintosh's electrical theory of the universe. Mr. M. ascribes the revolution of the planets round the sun, to the action of gravity urging them down an inclined plane. This is a good way to account for it, and very simple. He supposes that when a comet first leaves the sun, it is repelled from it by being charged with the same electricity. Now I suppose this electricity to be identical with heat; that while the comet is highly charged, or in a great state of heat, the matter of which it is composed is suspended in an aerial form; that after cooling a little it becomes condensed, not into earth and water, but into a mixture of both; and that, being in a high state of heat, and consequently like all substances so situated, not held together by any great attraction, it will divide into a planet and satellites, taking their stations on the verge of the solar system. A gloomy darkness will now prevail; and although a planet so formed be too far distant from the sun to receive much of his light and warmth, yet the internal heat will be sufficient to enable those huge monsters which we find buried deepest in the bowels of our earth to commence their reign. In the course of time, the smaller satellites cooling, fall into the planet, burying these monsters, making in the place where they fall continents of drier and harder materials, fit for animals of a higher order. These are in their turn buried, to make room for other animals of a still higher class, intermixed with plants and vegetables; which are again buried by the falling of some other of the satellites; the animals destined to fulfil some purpose of which we are ignorant, and the forests to be converted into coal for the use of man. The more fluid part of each satellite as it falls will spread itself over the surface of the planet; and the more solid, form where it falls a continent, distinguished by its peculiar description of plants and animals. As the heat of the planet is gradually dissipated, it becomes less repelled by the sun, which it consequently gradually approaches; for I am of opinion that, like a bottle exposed to the sun wrapped in wet flannel, the internal temperature of the planets is not increased, but greatly decreased by its action. Man is at length created rude and savage, but as he gradually approaches the sun his intellect improves, until his planet having become the nearest to the sun the millenium commences, which lasts until the planet, having parted with most of its internal heat, is no longer sufficiently repelled by the sun to overcome the force of gravity, and consequently falls into it to be again heated and again expelled to undergo a similar routine.

Any one who studies the formation of our planet—who looks at the animals that have once inhabited it, formed like the crocodiles and alligators, to live only in very warm climates, and attended also to the proofs of great internal heat having at one time acted upon the materials of our globe, will be convinced that these things cannot be accounted for by the action of the sun on our planet at the distance at which we now are.

According to Mr. Mackintosh's theory, we must suppose Herschel to be inhabited by the Saurians and other monsters; Jupiter and Saturn by others of a higher description, and also plants. The fact of the more distant planets being attended by so many satellites, tends greatly to the support of this theory; and if the procession of the equinox could be ascribed to the gradual approach of our planet towards the sun, this would be an additional confirmation.—Yours, &c.

G W. L.

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NOTES AND NOTICES.

The Cossipore Foundry Roof.—The following extract from the *Calcutta Courier*, which we omitted to give along with the description of this skilfully constructed roof inserted in our last Number, places the saving of material and expense effected by it in a very striking light. "The roof is coppered, but notwithstanding the expense of the copper (about 6,000 rupees), the entire cost of it, we are assured, did not exceed 11,000 rupees, exclusive of the original cost of the iron beams, which belonged to Government, and had long been lying near the Fort; and so little timber has been expended in the construction, that it is calculated there is a saving of more than 300 tons in weight compared with an ordinary roof of the same magnitude, and without reference to the increasing proportions and extra lateral supports which the great span would have required. The saving in expense is even more remarkable; for even at the common rate for laying a terraced roof the charge would have been upwards of 15,000 rupees, and the estimate given in by a professional man for an *iron roof* (or rather a trussed roof of timber, with only iron ties and braces), was actually 40,000 rupees. The whole merit of this most creditable construction of science and simplicity rests with Major Hutchinson, the superintendent of the works."

The Hereford Bone-Crushing Machine.—Sir,—In your Magazine dated 7th November, I see *amongst the "Notes and Notices"* a paragraph taken from a Hereford paper, giving an account of an *experimental* trial at the Hereford Foundry of a double-cylinder bone-grinding machine; in which, after stating the *intention* of the wonderful mill, the writer proceeds to say, that "should the enterprising proprietor succeed in *perfecting* the machine," &c., thereby implying that the thing is a new invention, not yet arrived at complete maturity. I happened to be at Hereford at the time, and hastened to the foundry, expecting to see something new, when, to my surprise, I found a machine which has been used in the docks at Liverpool for many years to grind mortar, clay, &c., and which was positively purchased at Liverpool and brought to Hereford to amuse the natives as a "*rara avis.*" The bait seemed to have taken, as numbers flocked to see the *wonder!* As to "perfecting" the machine, nothing is left to be done in that way, and with respect to its *utility* for the purposes assigned, the grossest ignorance alone could have suggested its application to the crushing of bones, and similar substances. The construction of this vaunted machine must be familiar to all your readers. It is a revolving pan, on which lie two rollers, that are forced round by the resistance of the articles to be ground, and is excellent for mortar, small sand, stones, &c., but quite inapplicable to such organic substances as bones. I forgot to inquire the name of the inventor at Liverpool; but certainly it is not a Hereford invention, as implied in the paragraph.—I am, Sir, yours respectfully, A TRAVELLER.

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LIST OF NEW PATENTS, GRANTED BETWEEN THE 24TH OF DECEMBER AND 24TH OF JANUARY, 1836.

John Fussell, of Nunney, Somerset, edge toolmaker, for improvements in pumps. Dec. 29; six months to specify.

Joseph Skinner, of Fen-court, London, civil engineer, for improvements in machinery for cutting wood for veneers and other purposes. Dec. 29; six months.

John Hyde, of Ashton-under-Lyne, Lancaster, cotton manufacturer, for improvements in machinery for carding cotton and other fibrous substances. Dec. 31; six months.

Pierre Erard, of Great Marlborough-street, musical instrument-maker, for certain improvements on piano-fortes and other keyed musical instruments for the term of seven years, from the 22nd day of December instant; being an extension of former Letters Patent granted to Pierre Erard by his late Majesty, King George IV. Dec. 31.

John Blyth, of Limehouse, engineer, for an improved method of retarding the progress of carriages in certain cases. Dec. 31; six months.]

Theodore Lyman Wright, of Sloane-street, Chelsea, for a certain improvement or certain improvements in machinery or apparatus for cleansing, purifying, and preparing feathers and down for domestic uses, and in the process or method of effecting the same; being a communication from a foreigner residing abroad. Dec. 31; six months.

James Champion, of Salford, Lancaster, machine-maker, for certain improvements in machinery for spinning, twisting, and doubling cotton and other fibrous substances. Jan. 6, 1836; six months.

John Ramsbottom, of Todmorden, Lancaster, mechanist, for certain improvements in machinery for roving, spinning, and doubling cotton and other fibrous substances. Jan. 6; six months.

William Harter, of Manchester, silk manufacturer, for certain improvements in machinery for winding, cleaning, drawing, and doubling hard and soft silk. Jan. 8; six months.

Francis Brewin, Kent-road, Surrey, tanner, for his invention of certain new and improved processes of tanning. Jan. 11; six months.

I. Tilton Slade, of Fitzroy-square, for certain new or improved machinery for raising earth and for other useful purposes. Jan. 11; six months.

John Ward Higham, of Tavistock-street, for an improved tablet for sharpening of razors, penknives, surgical instruments, chisels, plane irons, and other steel instruments which are capable of being sharpened by what are commonly called hones, Turkey-stones, or Welch-stones. Jan. 11; two months.

John Burns Smith, of Salford, Lancaster, cotton-spinner, and John Smith, of Halifax, York, dyer, for a certain method or methods of tentering, stretching, or keeping out cloth to its width, made either of cotton, silk, wool, or any other fibrous substances by machinery. Jan. 14; six months.

Moses Poole, of Lincoln's-inn, for improvements in jacquard looms; being a communication from a foreigner residing abroad. Jan. 19; six months.

Charles Brandt, of Upper Belgrave-place, mechanist, for certain improvements in heating, evaporating, and cooling fluids. Jan. 19; six months.

Francis Moll, of Grove-lane-terrace, Camberwell, for improvements in preserving certain vegetable substances from decay. Jan. 19; six months.

Charles Harsleben, of No. 95, Bold-street, Liverpool, for certain improvements in the machinery and arrangements for the use of propelling vessels and other floating bodies, as also carriages and other vehicles on railroads, as well as on common roads; part of which machinery is also applicable to other purposes. Jan. 19; six months.

Robert Bowie, of Bishopsgate-street Within, surgeon, for certain improvements in distillation and decoction, which improvements are more or less applicable to the heating of fluids of all descriptions; as also to the purification of oleaginous bodies, both animal and vegetable. Jan. 21; six months.

John Ferrabee, of the Thrupp, Stroud, Gloucester, engineer, and Richard Clyburn, of the same place, engineer, for certain improvements in power-looms. Jan. 21; six months.

William Burch, Borough-road, Surrey, calico and silk printer, for certain improvements in machinery for printing silk and cotton, net or lace. Jan. 23; six months.

Julius Jeffreys, of Osnaburgh-street, Regent's-park, for improvements in curing or relieving disorders of the lungs. Jan. 23; six months.

Henry Booth, of Liverpool, for improvements applicable to locomotive steam-engines and railway-carriages. Jan. 23; two months.

Henry Pickworth, Sipson, Middlesex, for certain improvements in machinery for propelling vessels and other floating bodies moved by steam or other power. Jan. 26; six months.

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LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22ND DECEMBER, 1835, AND 22ND JANUARY, 1836, INCLUSIVE.

Joseph Skinner, of Fen-court, in the city of London, civil engineer, for improvements in machinery for cutting wood for veneers and other purposes. Sealed at Edinburgh, Dec. 24, 1835.

John Joseph Charles Sheridan, of Walworth, in *the county of Surrey, chemist, for* an improvement *in the manufacture of soap.* Dec. 24.

William Symington of Bromley, in the county of Middlesex, cooper, for certain improvements in the steam-engine and in the machinery and apparatus for propelling vessels by steam. Dec. 31.

James Bullough, of Blackburn, in the county of Lancaster, mechanic, for certain improvements in hand-looms and power-looms. Jan. 8, 1836.

Elijah Galloway, of Westmoreland-place, City-road, in the county of Middlesex, engineer, for certain improvements in steam-engines, which improvements are applicable to other purposes. Jan. 8.

John Malam, of Kingston-upon-Hull, in the county of York, civil engineer, for certain improvements in gas-meters and in the apparatus for generating gas for illumination. Jan. 11.

Joseph Whitworth, of Manchester, in the county palatine of Lancaster, engineer, for certain improvements in machinery for spinning, twisting, and doubling cotton, flax, wool, and other fibrous substances. Jan. 14.

William Harter, of Manchester, silk manufacturer, for certain improvements in machinery for winding, cleaning, drawing, and doubling hard and soft silk; which improvements are also applicable to machinery for winding, cleaning, and doubling thread or yarn manufactured from cotton or other fibrous materials. Jan. 15.

Thomas Jevons, of Liverpool, in the county of Lancaster, for an invention communicated to him by a certain foreigner residing abroad, for certain improved machinery to be used in manufacturing bars or wrought-iron into shoes for horses, and also into shapes for other purposes. Jan. 15.

Thomas Greig, of Rose Bank, in the parish of Bury, in the county of Lancaster, calico printer, for a mode of embossing and printing at one and the same time, by means of a cylinder or roller on goods or fabrics made of or from cotton, silk, flax, hemp, and wool, or any one or more of those materials, or on paper. Jan. 18.

Andrew Smith, of Princes-street, Hay Market, in the county of Middlesex, engineer, for a new standing rigging for ships and vessels, and a new method of fitting and using it. Jan. 19

John Day, of York Terrace, Peckham, in the county of Surrey, gentleman, for an improved wheel for carriages of different descriptions. Jan. 20.

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price *6d.* Also, the volume complete, in boards, price *9s. 6d.*

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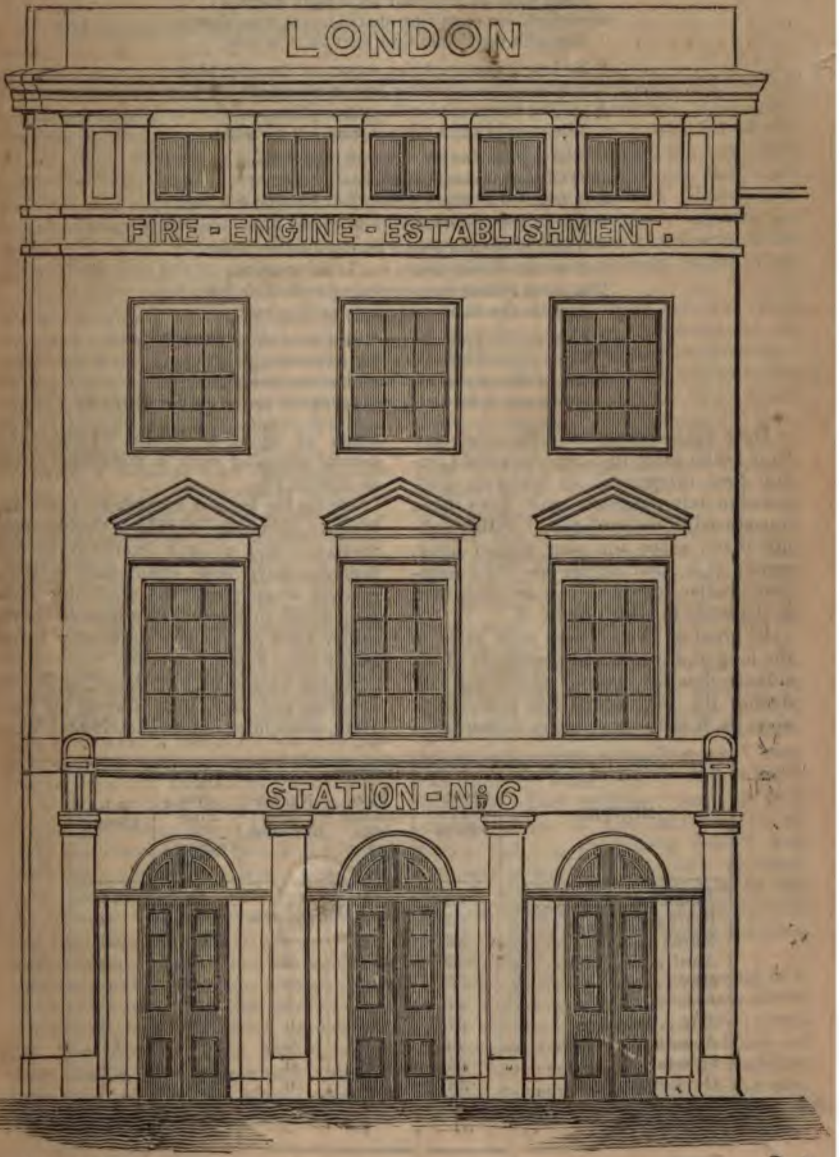
LONDON FIRE-ESTABLISHMENT.



LONDON FIRES IN 1835.

" The diligence of Trade, and noiseful Gain
And Luxury, more late, asleep were laid;
All was the Night's and, in her silent reign,
No sound the rest of Nature did invade.

" In this deep quiet (from what source unknown!)
Some seeds of fire their fatal birth disclose;
And, first, few scatt'ring sparks about were blown,
Big with the flames that bent on ruin rose.

" At length the crackling noise and dreadful blaze
Call'd up some waking lover to the sight;
And long it was ere he the rest could raise,
Whose heavy eye-lids yet were full of night.

" The next to danger, hot pursu'd by Fate,
Half-cloth'd, half-naked, hastily retire;
And frighted mothers strike their breasts, too late,
For helpless infants left amidst the fire.

" Their cries soon waken all the dwellers near,
Now murm'ring noises rise in ev'ry street;
The more remote run stumbling with their fear,
And, in the dark, men jostle as they meet.

" Now streets grow throng'd and busy as by day:
Some run for buckets to the hallow'd quire;
Some cut the pipes, and some the engines play;
And some, more bold, mount ladders to the fire."—DRYDEN.

Dear Sir,—Whatever differences may have taken place in the character of London fires in general, or whatever progressive improvements may have been introduced in the methods of extinguishing them, since the poet quoted sang, certain it is, that neither are their numbers smaller, nor their terrors less, than in the times in which he lived.

In proof of this, I need only refer to the long and melancholy catalogue of accidents detailed below, premising that during the year which has just closed upon us, fires have been very numerous—many of them of fearful extent, and several attended with a melancholy loss of human life.

By far the greater number of these calamities, however—thanks to the constant vigilance and prompt exertions of our firemen—have been suppressed in their earliest stages; and the appalling dangers which in many cases appeared inevitable, have by their praiseworthy intrepidity been happily averted.

There have been 643 alarms of fire in London, and its vicinity, during the year 1835, as set forth in the following table:—

MONTHS.	Number of Fires.	Number of Fires attended with Loss of Life.	Number of Lives Lost.	Alarms from Fires in Chimneys.	False Alarms.
January	38	1	1	12	1
February	40	0	0	8	2
March	36	2	4	10	3
April	45	1	2	12	5
May	35	0	0	2	5
June	37	1	1	6	3
July	37	0	0	4	6
August	48	0	0	3	11
September	35	0	0	9	3
October	33	0	0	9	9
November	36	1	1	14	10
December	51	1	5	17	8
Total	471	7	14	106	66

The number of fires where the premises in which they occurred have been consumed, is	31
Considerably damaged	125
Slightly damaged	315
	471
Alarms, from fires in chimneys	106
False alarms	66
Making the total number of calls	643

The number of alarms from fires in chimneys, quoted in the foregoing table, does not include any calls to chimneys on fire, stated at the time to be such, but only those that were represented to be *bad fires*, and attended accordingly. The actual number of chimneys on fire in the metropolis varies, as stated in a former report, from 100 to 150 per month!

Persons frequently ridicule the idea of firemen attending chimneys on fire, and in many cases, it is true, that their services are superfluous; but instances are by no means unfrequent, nay, they are almost of daily occurrence, where the firemen's aid proves not only useful, but actually necessary, to prevent that, which in itself is trifling, from becoming the source of serious and extensive mischief. No longer ago than in December last, a chimney took fire at Mr. Knight's, Upper King-street, Bloomsbury, at half past 2 p.m.. The firemen were called to *a large fire*, and three of the Establishment engines, with a proper complement of men, hastened to the spot; upon their arrival they were informed it was "only a chimney," and were refused admittance. After several ineffectual attempts to obtain an entrance, and after the fire appeared to be extinguished, the men departed, and all seemed to go on well, till about a quarter before ten o'clock the same night, when flames suddenly burst forth in a closet on the second floor, the fire having slowly crept along some timbers, most improperly placed close upon the chimney. The closet was burned out, and the joists, flooring, stock and furniture, damaged, before the fire could be subdued, and much alarm created in the neighbourhood. Had the proffered assistance of the firemen been accepted in the first instance, it is pretty certain their second attendance would not have been required. People often ignorantly imagine, that by refusing admittance to the firemen they can escape payment of the rewards; this, however, is a great mistake, and is often productive of serious results. The fact is, the imperfect and careless manner in which buildings in general, and flues and chimneys in particular, are constructed, requires the utmost watchfulness to guard against the spread of those mischiefs which they continually generate.

Although almost every body has heard of rewards to be paid to firemen for attending with their engines at fires, few but those who have had the misfortune to be called upon to pay them, know much about the subject. The statute (14 Geo. III. cap. 78) directs that there shall be paid by the churchwardens or overseers of the poor of the parish in which any fire happens, *thirty shillings* for the first engine that shall arrive in good order, *twenty shillings* for the second, and *ten shillings* for the third; also *ten shillings* for the turncock who shall draw the first water-plug. These rewards the churchwardens or overseers are bound to pay, on the production to them of the certificate or direction, if in the country, of one of the justices of the peace; and if in the city of London, of the Alderman, his deputy, or two of the Common Councilmen of the ward; and if such rewards shall have been paid for "any fire in a chimney only, or first beginning in, or occasioned by, the taking fire of any chimney only, then the tenant or occupier is to repay the churchwarden the rewards so paid, or such part thereof as the magistrate shall, on hearing the case, award and direct."

Although the false alarms amount to a considerable number in the course of the year, still the present is the smallest number reported for some time. Many of them have originated in a laudable anxiety to prevent mischief, on the part of individuals not sufficiently conversant with these matters, accurately to discriminate between real and apparent danger. It is true, many of the appearances have been sufficiently specious to deceive the most experienced judgment—especially some of the atmospheric phenomena, which have been of rather frequent occurrence during the year. One in particular on the 17th and 18th of November, gave the London Fire-Establishment a great deal of trouble; 74 of their men and 12 engines being kept in almost constant motion from 11 p. m. of the 17th, till 6 o'clock of the following morning, pursuing a number of false alarms of fire, which were occasioned by a succession of those brilliant phenomena scientifically known as the *aurora borealis*, or more popularly as the *northern lights*, and which, from some peculiar modification of the atmosphere, presented the appearance of wide-spreading conflagrations.

The first alarm occurred, as before stated, at eleven o'clock at night, when the men at the Jeffrey's-square station, in St. Mary-Axe, distinctly saw what they conceived to be a tremendous fire in the direction of Hackney or Kingsland. The engine was instantly got out, and the alarm forwarded to the head-station in Watling-street; but by the time the men got to Shoreditch, the bright glare of light that had allured them thus far, after various shiftings and changes of hue, gradually disappeared. The other engines that were following saw very little of these singular appearances. At three o'clock in the morning a fresh alarm reached the head-station of a dreadful fire at Hampstead, and Mr. Braidwood, the superintendent, himself went out with one of the engines on this occasion. At this time the southern side of the dome of St. Paul's Cathedral was brilliantly illuminated by a reflected light, and no doubt existed of the correctness of this call. On reaching Gray's-Inn-road, in a direction nearly due north, a strong red glare of light was seen rising from the horizon to a height of about 30°. All the policemen they passed agreed that it was a terrible fire, and had been raging some time. As the firemen advanced, a cloud intervened, and the light appeared to become more distant, and then became paler, shifting from north-north-west to nearly north-west. These changes convinced Mr. Braidwood that the appearances were completely illusory, and on reaching King's Cross he determined on turning back. The appearance of the lights as viewed from this spot is described as being peculiarly brilliant and interesting. Several alarms were subsequently received, and from the official returns to the head-station, it appears that some of the engines went to Hampstead, and others to Kilburn, but all on idle errands. The last alarm was for Hampstead at six o'clock in the morning. The night was throughout clear, and the stars shining brightly. A phenomenon very similar in appearance to the above, and attended with the same results, viz. a general turn-out of the firemen and engines, was described at p. 14 of your 16th volume; with this difference, that the red glare of light upon that occasion appeared in the *east*, about two hours before sunrise.

Too much praise cannot be awarded to the firemen for the alacrity with which they are in motion, on an alarm of fire being given at any of their stations. Proper caution is always exercised in receiving calls from strangers, which is highly beneficial; but as all the men of the Establishment would rather turn out twenty times to no purpose than be five minutes behind-hand at a fire, they must sometimes inevitably go on useless errands.

Although the present report gives an increase on that of 1834, in the numbers of the *consumed* and *considerably damaged*, it is still below the returns for the year previous. Several untoward circumstances have operated to extend the number of serious fires beyond the usual amount.

Of the *thirty-one consumed*, eight fires were at so great a distance from the nearest engine-station, that the London firemen stood no chance of reaching the spot until after the fire had been raging for a considerable time.

The first of these fires occurred at Brentford on the 19th of January, eight miles from the Establishment's nearest station; the town was at the time a scene of drunken revelry and confusion, in consequence of the election, and three buildings were consumed before the fire could be stopped.

The next distant fire took place on the

18th of March, at Stoke Newington, 4 miles from town, when the premises in which the fire originated were alone consumed.

On the 18th of June, a fire occurred at Marsh Gate, Homerton, also four miles off, which was confined to the coach-house, stables, and laundry, these being consumed. July 2, a fire broke out at Messrs. Abbot's soap and candle manufactory, Angel-terrace, Hammersmith, where, in addition to the distance (three miles), the firemen had to contend with the difficulty arising from want of water; fire-plugs there were none, and when the main-pipes were cut they yielded a very small quantity of water. Notwithstanding these unfavourable circumstances, Messrs. Abbot's premises only were consumed, the fire being beaten in seven other buildings to which it had communicated.

On the 5th of August, the Old Red Lion, at Barnes, Surrey, was burned down; this building was wholly consumed before any effectual aid could reach it, the nearest station being at least six miles distant.

A large incendiary fire occurred at Beckley-farm, near Bromley, Kent, on the 15th of August, where thirty stacks of corn, seven of hay, with an extensive range of stabling, granary, lodges, sheds, &c., were consumed. Notwithstanding the distance—twelve miles—three of the Establishment engines were *third, fourth*, and *sixth* on the spot. A private engine was first, a parish engine next, and before the second parish engine arrived, two of the London engines were on the spot!

August 23, an alarming fire at Barnet required the presence of the London firemen; this fire broke out on the premises of Mr. Smith, tallow-melter, all of which were consumed, and ten other buildings damaged. The distance is eleven miles; nevertheless, one of the Establishment engines was the third at the fire!

The last distant fire, in this class, occurred on the 9th of October, when Ashburton House, a splendid mansion on Putney-heath, was destroyed by fire. The premises were at the time unoccupied, except by a policeman in charge of them, and were wholly consumed before any assistance could be rendered. The destruction of this building originated in an ignited *flue: the distance* from town *is about four miles.*

In eight other instances, the buildings in which the conflagrations originated were so completely on fire before any alarm was given, that it proved quite impossible to prevent their entire destruction; these fires were also for the most part on the outskirts of the metropolis, and the buildings in general very small.

In six cases, the total destruction of the premises has been solely attributable to the late and scanty supply of water which was obtained. This was particularly the case at Bermondsey-street, in February, when four buildings were consumed, and several others damaged; at Silver-street, Golden-square, in March, when five buildings were consumed, and twenty others more or less damaged; at Bermondsey-wall, in April, when one building was consumed, and three others damaged; at Charter-House-square, in August, when five buildings were burned down, and nearly thirty others damaged; at Rupert-street, Haymarket, in the same month, when two buildings were consumed, and ten others damaged; and also at Bridgewater-square, in the very same month, when five of the premises were entirely destroyed, and nineteen much injured.

The remaining nine fires, in this division, owe their complete destruction to the combustible character of the buildings themselves, being mostly composed of timber, and to the inflammable nature of their contents.

Of the 125 fires, at which considerable damage was sustained, each one presented a desperate struggle for the mastery, between the firemen and the powerful element to which they were opposed. In all these cases, however, the coolness, perseverance, and intrepidity of the firemen, ultimately triumphed.

The following list exhibits a classification of the trades occupying the premises at which the foregoing fires have taken place; care having been taken to discriminate between the fires that originated in that part of the building occupied in trade or manufacture, and those that have happened in and damaged the dwelling parts only, by placing the latter under the respective heads of private dwellings or lodging-houses, for the purpose of showing the comparative liability of each particular calling to accident from fire:—

Bakers	18
Basket-makers	2
Booksellers, Binders, and Stationers	2
Brewers	1
Brokers	10
Builders	1
Butchers	1
Cabinet-makers	9
Cane-dyers	2
Carpenters and workers in wood, not Cabinet-makers	13
Chandlers	4
Chemists, manufacturing	3
Coach-makers	2
Coach-painters	1
Coffee-roasters	2
Coffee-shops and Chop-houses	7
Colour-makers	2
Confectioners	1
Cork-burners	2
Curriers	2
Distillers	1
Dyers	2
Eating-houses	3
Farms	3
Feather Merchants	2
Fellmongers	1
Gaming-houses	2
Gas-works	1
Glass-blowers, private	1
Grocers	5
Hat-makers	2
Horse-hair Merchants	1
India-rubber Manufacturers	1
Lamp-black-makers	1
Lodgings	48
Lucifer Match-maker	1
Maltsters	2
Marine-stores, dealers in,	1
Carried forward	163
Brought forward	163
Oil and Colour-men	7
Oil and Pickle-merchants	1
Painters and Glaziers	1
Paper-stainers	1
Paper-hangers	1
Pastry-cooks	2
Pawnbrokers	1
Picture-dealer	1
Pitch-maker	1
Printers, Letter-press	4
Printers, Copper-plate	2
Private dwellings	145
Prison	1
Public Dancing-room	1
Rag-merchants	2
Rope-maker	1
Sale-shops (no hazardous goods)	47
Saw-mill	1
Ships	3
Ships, steam	2
Ship-builders	2
Soap and Candle-makers	2
Stables	7
Starch-makers	1
Tallow Chandlers	4
Theatre	1
Tinmen, Braziers, and Smiths	5
Under repair	5
Unoccupied	8
Varnish-makers	1
Victuallers	32
Vitriol-makers	1
Warehouses	3
Weavers	1
Wine and Spirit-merchants	7
Woolstaplers	2
Workhouses	1
Total	471

The following table shows the distribution of these fires throughout the twenty-four hours:—

	First Hour.	Second Hour.	Third Hour.	Fourth Hour.	Fifth Hour.	Sixth Hour.	Seventh Hour.	Eighth Hour.	Ninth Hour.	Tenth Hour.	Eleventh Hour.	Twelfth Hour.
A.M.	16	19	11	19	10	15	13	8	10	12	12	17
P.M.	22	21	25	26	25	22	24	40	25	21	24	34

The daily distribution has been remarkably uniform, viz.:—

Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.
62	72	66	67	63	65	76

Making the annual average of fires for any particular day in the week sixty-seven.

The usual vigilance has been exercised, to ascertain as far as possible the causes which have led to these fires; but much difficulty necessarily attends the prosecution of this inquiry, and in nearly a hundred cases it has been found absolutely impossible to determine the origin of fires. Enough has been done, however, to show, that the causes are very much of the usual character, and the perusal of this summary, if properly considered, furnishes a highly useful lesson to all persons.

There have been fires occasioned by accidents of various kinds, ascertained to be, for the most part, unavoidable	14
Bed-curtains set fire to	52
Candles, various accidents with,	36
Carelessness, palpable instances of,	19
Children playing with fire	5
Drunkenness	3
Fireworks	3
Fires kindled on hearths and other improper places	9
Flues and chimneys, defective, foul, or ignited	69
Fumigation and bug-hunting	7
Furnaces overheated, &c.	2
Gas, sundry accidents with,	39
Heating of hay and straw	3
Ditto of lampblack	1
Ditto of lime	4
Ditto of rags	1
Linen, incautiously hung before fires, &c.	22
Shavings, loose ignited	9
Stoves and stove-pipes, defective setting or overheating of, &c.	11
Trade, application of fire-heat to various purposes of, &c.	39
Tobacco-smoking	4
Unknown	91
Wilful	6
Window-curtains set fire to	22
Total	471

It will be observed, that much danger still arises from the imperfect construction of flues and chimneys, and also from the defective setting of stoves and stove-pipes. The shameful practice of builders introducing the ends of joists, pieces of bond timber, &c., closely abutting upon, or actually entering into flues, coupled with the negligence so often evinced by the occupiers of the buildings towards their efficient cleansing, are continually creating numberless annoyances, and placing lives and property, to a great extent, in imminent danger. The most fruitful source of accident, however, still continues to originate in the mismanagement of candles, especially in the vicinity of curtains, no fewer than 74 accidents of this description being recorded in the present report. Placing a candle near to either bed or window-curtains is a most improper practice; for, although the distance may be five or six inches, or even more, yet the opening of a door, the moving about of individuals, or a sudden gust of wind, may bring the curtains in contact with the flames, and, if prompt assistance be not at hand, may involve the premises in ruin. Mr. Dudley, in the *Tocsin*, very justly observes, "Fifty years ago, all bed-furniture, curtains, &c. were made of substantial stuffs; our forefathers would have laughed to scorn the idea of sleeping shrouded with chintz and gauze, and a twinkling gas-light, floating in a glass tumbler, which even a poor fly, with the vibration of its wings, will extinguish."

The fact is, that no *unguarded* light should ever be permitted in any stable, warehouse, cellar, or bed-chamber; cheap, convenient, and even elegant hand lamps and lanterns suited to these uses, are to be met with in abundance. It is an important fact, that no instance of accident by fire from the use of enclosed lights, has been met with among all the calamities of the last few years; neglect of this precaution, however, caused the destruction of thirty buildings in Charter-house-square alone last year. Open, exposed lamps, have occasioned serious accidents, for they are not a whit better than candles; but enclosed within glass walls, the light is greatly improved, and the chance of accident incomparably small; indeed, with even ordinary care, such an event is next to impossible.

Several accidents have arisen from want of proper care in repairing of gas-pipes and fittings. Surely the men employed upon such work ought, above all others, to be well aware of the consequences of bringing a light near an open gas-pipe. Several of these accidents evince, either an ignorance or a thoughtlessness, that exceeds all belief.

It is my painful task to record seven fatal fires in 1835, which have been attended with a loss of 14 lives.

The first of these occurred on the 17th of January, when Mrs. Davenport, an aged and infirm lady, was burned to death in her residence, No. 4, Sussex-place, Canonbury-place, Islington; the origin of the fire was never discovered.

The next occurred on the 2d of March, when the premises of Messrs. Tapprel and Holland, cabinet-makers, in Tent-court, Silver-street, Golden-square, were consumed, and many other buildings much injured. The body of a sweep, unknown, was found by the firemen while digging on the ruins three days afterwards, and it is generally supposed that he was killed by the falling of a wall, from which several of the firemen had a most miraculous escape. On the 17th of the same month, three young girls, employed in Mr. Bell's Lucifer-match manufactory, at Wandsworth, were killed by an accidental combustion of the highly dangerous materials on which they were at work.

The fourth fatal fire occurred on the 30th of April, at Mr. Wheeler's, baker, No. 1, Canning-place, Old-street: whose premises were consumed, and his niece and the female servant were burned in their beds, before any alarm could be given. Mr. Wheeler and his men escaped from the lower part of the premises, with the greatest difficulty.

On the 18th of June a child set fire *to its clothes*, and was burned to death, *in Husband-street*, St. James's; and, on the 16th November, a similar accident happened in Oakley-street, Lambeth.

The last fatal fire was that on the 1st of December, at the house of Messrs. Chinnock and Son, cabinet-makers, in Tottenham-court-road, when five persons perished; viz. a male lodger, who was at the time so much intoxicated as to be unable to perceive his danger, or to make any effort towards effecting his escape; a child who died from the injuries it received in being dropped from an upper window; and three young females, who, in their terror, fled into a back apartment, from which there could be no escape, and thus unfortunately shut themselves out from the possibility of any external assistance being rendered to them.

No intelligence of the conflagration at Hatfield House, Hertfordshire, having been given at either of the London Fire Establishment Stations, it was not attended by any of their men or engines; that fire, therefore, with its fatal result, is not included in this report.

Of the above fourteen unfortunate individuals, two only could have been rescued from their untimely fate by any human effort; these were the male lodger at Messrs. Chinnock's and the child; these two lives, under the most favourable circumstances (such as convenient apparatus, with skilful assistants being on the immediate spot), might possibly have been saved; but, in all the other cases, life was extinct before any alarm was raised; and, therefore, before any assistance could possibly be afforded.

In consequence of the melancholy loss of life at Messrs. Chinnock's fire, much excitement was occasioned in the public mind, especially in the immediate neighbourhood of that calamity. A meeting of the inhabitants of St. Pancras was held at the Fitzroy tavern, Charlotte-street, at which it was resolved to provide an engine and fire-ladders in the south-western district of that parish, to prevent, as far as possible, the recurrence of such a frightful catastrophe as that just adverted to. The committee appointed to carry this resolution into effect, have accordingly purchased a powerful fire-engine, equipped in the most complete manner, and ordered three sets (of six lengths each) of the portable fire-ladders employed by the firemen of the London Establishment, which are to be judiciously stationed in the district; a key to be kept by each member of the committee, by the policemen on duty, and at the public-houses in the vicinity. The committee have likewise selected a fire-escape of a very superior character, previously adopted at Liverpool, invented by Mr. Ford, of which your readers will most likely learn more hereafter.

It is highly important that the public should know that each of the large engines belonging to the London Fire-Establishment carries with it at all times three most efficient means of assisting in the preservation of life from a house on fire, where the opportunity of escape by door, or along the roof, is unhappily cut off. There are in all twenty-three engines, so provided, belonging to this establishment, stationed in various parts of the metropolis; and, on the occasion of the dreadful calamity in Tottenham-court-road, could the inmates have remained in the building till some of the engines arrived, the fearful sacrifice of life that took place there might have been averted; but, unfortunately, the flames spread so rapidly, that, before any engine could reach the spot—in fact, almost as soon as the alarm was given—the building became one blaze of fire from top to bottom.

The means of escape alluded to are these:—First, each engine carries two seven-feet lengths of the improved scaling-ladders; which have been fully described at page 184 of your 22d volume. The two lengths, when joined, which can be done in an instant, form a ladder thirteen feet high; one foot being lost in the junction. As all the lengths of ladder carried by the different engines are constructed precisely alike, the arrival of a second engine admits of an immediate doubling of the length of the ladder. Three engines (and there are generally from eight to ten in immediate attendance at any fire of magnitude) would afford a ladder of forty feet length, which is amply sufficient for all ordinary occasions; but, if necessary, it might, by further junctions, be lengthened almost indefinitely.

Secondly,—Each engine is provided with one of *Buston's fire-escapes*, which *consists of a large and strong* canvas sheet, with hand-holes at the sides, so that, when held extended, a person may jump into it from a lofty window, without any great risk.

The third means of assistance carried are, two strong lines of 2-inch rope, and a slighter one; each of great length. The end of one of these ropes being conveyed to the window, would afford to the endangered person a mode of escape that the most timid might avail himself of. It would only be necessary to pass the rope once round a bed-post, a strong hook, the bar of a grate, or almost any fixture, and then fasten it round his waist, and, getting out of the window, the firemen would retain the other end of the rope, and gradually lower him to the ground. There are also many other ways in which the ropes might be rendered available for the same purpose.

Mr. Braidwood suggests that it would be an excellent means of increased safety, if several lengths of the improved ladders were kept at each police-station. They might, without the least inconvenience, be hung up in separate lengths against the sides of the station-room, and could be readily lifted down and run off with to the scene of any dangerous fire. A policeman might with ease carry two lengths, and yet proceed at a running pace, or even four lengths for a short distance, without any extraordinary exertion of strength. A canvas sheet and rope-lines might be likewise kept at the police-stations, as additional means of assistance.

At any rate, the present parochial fire-ladders should be placed in convenient and accessible situations. They should be hung up within reach, and no locks should, upon any account, be permitted longer to make them fixtures to the walls. I know that many persons object to discontinue the locks; arguing, that, if the ladders were not so fastened, they would inevitably be stolen; but this may be prevented by a very simple expedient: let all the fire-ladders be branded, and annually painted RED. No parties could remove either a two or a three-story ladder far, without being seen by the watchmen or police, who would then immediately recognise the ladder by its colour, and would know that their services were required at the spot to which it was being conveyed; or, if being improperly removed, would instantly detect and apprehend the offenders.

The efficiently-equipped and well-trained body of firemen who now protect the metropolis, have rendered any other provision much less needful than it formerly was; but, when we consider that, out of nearly 500 fires last year, seven of them attended with loss of life, only one instance occurred in which *external aid* could have been useful, the necessity of *internal* and individual modes of escape becomes strikingly apparent.

A modern writer (Leigh Hunt) very justly says, "All the fires in this great metropolis, and the frightful catastrophes which are often the result, do not show the inhabitants that they ought to take measures to guard against them, and that these measures are among the easiest things in the world: every man who has a family, and whose house is too high to allow of jumping out of the windows, ought to consider himself *bound* to have a fire-escape. What signifies all the care he has taken to be a good husband or father, and all the provision he has made for the well-being of his children in after life, if, in one frightful moment, in the dead of night, with horror glaring in their faces, and tender and despairing words swallowed up in burning and suffocation, amidst cracking beams and rafters, sinking floors, and a whole yielding gulf of agony, they are all to cease to be!—to perish like so many vermin in a wall! A time, perhaps, will come, when every window in a high bed-chamber will have an escape to it, as a matter of course; but it is a terrible pity meanwhile, that, for want of a little imagination out of the common pale of their Mondays and Wednesdays, a whole metropolis, piquing themselves on their love of their families, should subject themselves, and the dearest objects of their affection, to these infernal accidents."

But, after all, the fourteen individuals alluded to above, form but a very small portion of the number of persons actually burned to death within the last twelve months. The number of persons who have lost their lives from igniting their wearing apparel, is truly *appalling*. Above a hundred individuals—*principally females and children*—have perished in this manner, dari the period under review. Scarcely newspaper can be taken up without fi ing one or more catastrophes of t kind recorded in its columns, the det of which too often display an awful n lect of every ordinary precaution, o lamentable disregard of the dictates common sense.

The practice of permitting child at any time to play with fire in shape, and of allowing unguarded fi where young children are left, are b highly culpable, and cannot be severely censured. High fenders, wire fire-guards, would prevent ma if not all, of these distressing calamiti which are continually harrowing up souls. These dreadful accidents f quently proceed from females standi too near the fire, when the opening the door, and the attraction of the fi draws the light material of their dre into the flame. When a female di covers her dress to be on fire, she t frequently runs screaming about t room; and if no one is there to assi her, she opens the door, and rushes o to seek assistance. By the motion the lighted clothes and the air, th greatest rapidity and fierceness a given to the fire, and the face, neck and arms are instantly enveloped i flames. The proper course, when a fe male finds her apparel on fire, woul be instantly to throw herself at ful length upon the floor—if possible on hearth-rug or carpet; by wrapping i round, the fire will be immediately ex tinguished. If neither of these thing are at hand, she should roll over on th floor until the part on fire is undermost and then press her clothes to the floo as well as she can with her hands. I her clothes are on fire all round, sh must keep rolling over and over, slowly the portion of dress that is under h will be extinguished, and the parts abo it will burn feebly and harmlessly, com pared to what they would do were th sufferer in an erect position. If ther is another person in the room, the on on fire should drop down, as directe above, and the other should imme diately throw a carpet, rug, woollen shawl, cloak, coat, or any incombus tible wrapper at hand, over the sufferer pressing it closely round her, until th fire is completely extinguished.

e disastrous consequences of a late
canty supply of water having been
ely felt at several large fires last
ier, particularly at those in Char-
ouse and Bridgewater-squares, much
o disapprobation was expressed,
ially in the districts where the evils
experienced. Several meetings
held in consequence, and the mat-
vas eventually taken up by the
t of Common Council; the result
is investigation, however, I must
till some more convenient oppor-
y, merely at this time stating, that
g last year I had the gratification
eing two contrivances of mine for
ning a speedy and convenient sup-
f water to fire-engines, extensively
uccessfully employed. These are,
ortable-dam, described at p. 190 of
eighth volume, and my improved
ing-board, noticed at p. 38 of your
th. The nature of this gratifica-
will be better understood, when I
that, for nearly thirteen years, I
been labouring incessantly to over-
the opposition made by ignorance
rejudice to their introduction. The
spirit of mischief that so long re-
l their adoption, still contrives
ly to circumscribe their general
lness. Sufficient has been done,
ver, fully to prove their practical
y; several of the Fire-Establishment
ies are provided with the portable-
(an improved construction of which
form the subject of another paper),
the men find a great saving of time
s use, from the facility afforded of
ng the engine to work—a suffi-
body of water being immediately
cted to cover the rose of the suc-
pipe, without any paving-stones
ng to be displaced. I have placed
rns of these simple contrivances
bono publico) with Mr. Merry-
her, engine-maker, Long-acre, of
m any that are required can be ob-
d.

have much pleasure in learning that
fire-police at Edinburgh, under Mr.
rson, and that at Manchester, under
Rose, continue to prove eminently
essful. The establishment more
ntly formed at Liverpool, also pro-
s well.

Paris, an excellent plan has re-
ly been *adopted, to familiarise the*
s of the line with the duties of firemen. A certain number of men are placed every day under the direction of the commandant of that body, and instructed in all the details of that service. The Parisian firemen have also lately introduced our countryman, Mr. Dean's pneumatic apparatus for enabling a fireman to go into apartments on fire, at those times when the smoke would inevitably suffocate any person not so protected. It will, doubtless, be in the recollection of many of your readers, that at a meeting of the Society for Preventing Loss of Life by Fire, held at No. 18, Aldermanbury, in February, 1829, Mr. Dean exhibited an apparatus, the efficacy of which he demonstrated by a very satisfactory experiment. In the yard adjoining to the room where the meeting was held, and in the view of a great portion of the assembly, a close room was purposely filled with the fumes from burning brimstone, and black coal smoke. The most noisome smoke having been generated, Mr. Dean, equipped with his apparatus, went boldly into the midst of it, and remained there for a considerable time, until called forth amid the plaudits of the meeting.

The apparatus employed, consisted of a leathern jacket and copper head-piece, a constant supply of pure air being thrown into it through a leather hose, by means of a pair of small bellows. Not finding any party willing to adopt his invention, in the way he proposed, he applied it to another widely different purpose, and attained much celebrity as a *diver*. The Parisians, however, have re-invented Dean's apparatus, and employed it for the purpose originally intended, with so much success, that an account of it has been sent over to us as a new, ingenious, and valuable *French invention*.

In some few cases, such, for instance, as fires in imperfectly ventilated cellars, it may, no doubt, be advantageously employed; but, in general, I think it would be found that the inconvenience arising from the *incumbrance* would more than counterbalance its occasional usefulness.

The London Fire-Establishment's engine-house in Farringdon-street, which is most eligibly situated, being very small and inconvenient, the committee of management purchased some houses in the same street, at the corner of Bear-alley, on the site of which they have caused a very handsome and capacious edifice to be erected, by Mr. Grimsdale, from the design of E. Brown, Esq., architect, a front elevation of which accompanies this paper. There is standing room for three engines on the ground floor in front, with a watch-room and convenient stabling behind. The upper part is occupied by the foreman of the district, and the men attached to this station. A very pretty geometrical staircase, the whole of the cisterns, sinks, some of the chimney-pieces, and the flat roof, are of thick slate, the extensive employment of which material does credit to the judgment of the builders. The general introduction of this highly useful article cannot be too strongly recommended; and the managers of the London Fire-Establishment ("with all the appliances and means to boot" which they here possess for suppressing fire) have set a praiseworthy example by its adaptation in this particular case. Prevention is always much better than cure; and I will assert, without fear of contradiction, that the universal employment of stairs of the above description, would, without any other precaution, go far to reduce very materially the amount of damage done to buildings by fire, and also to prevent the loss of life by which they are too frequently attended.

The engine-station in Bedfordbury being also inconveniently small, and rather out of the way, a suitable spot of ground has been selected in Chandos-street, Covent-garden, where a superior building will shortly be erected, and the engines transferred thither from the Bedfordbury station.

The following is a correct list of the present engine-stations belonging to the London Fire-Establishment, at any of which the most prompt and effectual assistance can at all times be obtained:—

No.	STATIONS.	No. of Engines.	No. of Men.
1†	Schoolhouse-lane, Ratcliffe	1	2
2*	Wellclose-square	3	10
3	Jeffrey-square, St. Mary-Axe	2	7
4	Whitecross-street	1	5
5*	Watling-street	3	10
6*	Farringdon-street	3	8
7	French-Horn-yard, High Holborn	1	5
8*	Bedfordbury, Covent Garden	3	8
9	Crown-street, Soho	2	5
10	Well-street, Oxford-street	1	5
11	Baker-street, Portman-square	1	4
12	King-street, Golden-square	2	6
13†	Horseferry-road, Westminster	1	1
14†	Pedlar's-acre, Lambeth	1	1
15	Waterloo-road	1	5
16	Southwark-bridge-road	2	7
17	Morgan's-lane, Tooley-street	1	5
18†	Paradise-row, Rotherhithe	1	2
19	Floating-engine—off King's Stairs, Rotherhithe	1	0
	Total	31	96

On the 31st of December, the London Fire-Establishment completed the third year of its existence, being the period for which it was originally formed. Its progress during this short space of time, has been such as to realise the best expectations of its founders, and has fully demonstrated its importance in a public point of view, as well as its great practical utility.

The immense advantages of the *united system,* during its brief career, must have been strikingly apparent to every attentive observer; one convincing proof of the opinion generally entertained of its advantages, is the fact, that all the London fire-offices,* except the *County*, have now joined the Establishment.

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* *These are double stations.*

† These are stations of extra engines.

These are the Alliance, Atlas, British, Globe, Guardian, Hand-in-hand, Imperial, London, Norwich Union, Phœnix, Protector, Royal Exchange, Scottish Union, Sun, Union, and Westminster Insurance Companies.

Great diligence is constantly exercised by Mr. Braidwood, the superintendent of the London Fire-Establishment, to render the men, both in equipment and discipline, as efficient as possible; and several improvements have been recently introduced, which want of room prevents my noticing in detail at present.

Mr. Braidwood never asks a man to go where he will not enter himself, or to execute any task that he would not himself readily perform; on the contrary, he instructs by example rather than by precept, and his conduct has been uniformly such as to merit the approbation of his employers, and to ensure the most cordial esteem and enthusiastic co-operation of the men under his command.

The firemen continue steadily improving, and their general character and progress have been of the most creditable and gratifying description. They have become quite *au fait* in the modern practice of entering burning buildings, which they now always do, as a matter of course, in the most fearless and intrepid manner.

Several of the men have particularly distinguished themselves in this way, and the good they have thus effected is almost incredible.

Notwithstanding the risk attendant on this arduous and frequently dangerous duty, I am happy to state that only one serious accident has resulted during the past year; this was the fracture of a thigh by John Pope, a junior fireman, at a fire which consumed the premises of Mr. Gregory, oilman, No. 4, Newington-causeway, on the morning of the 18th of April last. The highly inflammable contents of this building, with the great head the flames had attained before the fire was known, rendered it impossible to save the premises in which the fire originated: by great exertions, however, the destructive element was prevented from extending its ravages.

I have already had occasion to allude to the prompt attendance given by the London firemen at distant fires. In addition to those places before noticed, Croydon, Hendon, Tottenham, Wandsworth, Brixton, Battersea, Bow, Poplar, Stamford-hill, and many other places equally distant, have experienced the valuable assistance so speedily afforded by the engines of the London Establishment: at most of these places they have been second and third upon the spot.

Nearer home their attendance has been equally prompt. One evening last month (for I like recent cases), an alarm of fire was given at a house in Gracechurch-street: in a few minutes one engine from the station in Jeffrey-square, and two from the principal station in Watling-street, drew up first, second, and third, in gallant style; although there are not less than twelve parish and private engines within two hundred yards of the premises on fire! This is only one instance, however, out of a great number I could relate: in fact, whenever any delay occurs, it arises solely from the firemen not having been called. Although, generally speaking, the firemen have been greatly assisted by strangers having given intelligence of fires at the several stations, and frequently by the police having done so, yet cases have occurred where information has been improperly withheld so long as to occasion the most serious consequences. In the course of last year, several bad fires have occurred within a quarter of a mile of the principal engine station in Watling-street, which "*the proper authorities*" have suffered to burn for fifteen or twenty minutes after their discovery, before any intelligence has been forwarded to the proper quarter.

The admirable regulation for forwarding the *calls*, and also for stopping the engines when not required, constitutes one of the greatest beauties of the *combined system*: a force adequate to the exigencies of the case, is at all times in immediate attendance, while all superfluous running about is prevented.

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* The West-of England Insurance Office at Exeter has *an agent in London*, and this Company *still maintain a small separate* establishment.

Wishing the Establishment the success it so richly merits, and continued health and prosperity to all its members,

I remain, Sir, yours respectfully,

WM. BADDELEY.

10, Wilderness-row, Goswell-street,
Jan. 21, 1836.

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PROFESSOR BARLOW'S SECOND REPORT ON RAILWAYS.

Since the publication of his First Report (of which we gave a full abstract in No. 612), Mr. Barlow has been again engaged by the Directors of the London and Birmingham Railway " to visit the Liverpool and Manchester Railway, to view that line, and advise this Board as to the weight of rails, the description of chairs and fastenings, the distance of the supports, and the size of the blocks that he would advise the Directors to adopt; and to accompany such advice with any observations generally on the subject."

Accordingly, accompanied by two of the London Directors, and met at Liverpool by two of that town, he entered on his task, furnished by the liberality of the Liverpool and Manchester Railway Company with every necessary facility and accommodation.

The following extract, besides showing the necessity of the investigation, presents a vivid and faithful picture of the uncertainties and contradictions into which practical men fall when they despise the help of theorists, while it gives, and on proper grounds, the weight unquestionably due to the opinions formed by these same practical men from constant observation:—

> " We met, as appointed, at the Liverpool station of the Liverpool and Manchester line, and employed the first day in examining the state of the rails, chairs, and blocks, modes of fixing, and other particulars. In the course of this examination, I took the opportunity of inquiring on the spot the opinion of the resident engineers, contractors for repairs, workmen, and others, relative to these several points; but I was much disappointed to find those opinions, in most instances, discordant, and in many directly contradictory; a circumstance the more remarkable, as one would have thought that five years' incessant practice would have been sufficient to eradicate many early erroneous ideas.
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> "*I am not myself* a practical man, but *from my situation* and pursuits I have been for nearly thirty years in almost constant intercourse with two of the largest and most varied mechanical establishments in the kingdom, and have, during that time, witnessed or superintended a vast number of experiments and trials on various mechanical subjects, many of which I have afterwards been enabled to examine in the works at large; I am therefore, to a certain extent, acquainted with what theory gives, and what practice requires, and the limits it prescribes; so I am also with the views and arguments of practical men, who I know sometimes, like other persons, in their anxiety to avoid one evil lose sight of other collateral evils, which their remedy increases or creates; but I must say that I never saw this so strongly marked as on the present occasion, nor such a diversity of conflicting opinions on what appears so simple and plain a case. This is a circumstance much to be regretted, not only as regards the doubts which it naturally throws upon the mind of proprietors, embarking large amounts of capital in the undertaking, but also in respect to practical men themselves, whose judgment must suffer depreciation by such discordance. Opinions derived from long experience are exceedingly valuable, and outweigh all others, while they are consistent with facts and with each other; but they are worse than useless when they lead, as in this instance, to directly opposite conclusions.
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> " In making these remarks, I beg to be understood as intending no disrespect to the opinions of practical men generally, but simply to show that it was impossible, in this case, for me to be guided by them, and thereby to justify the plan I soon determined to adopt; viz. to avoid, as far as possible, argument founded on mere hypothesis, and to substitute for the latter, facts drawn from actual experiments, which should be made publicly, registered generally, and witnessed by any one interested in the decision; and moreover, as I intended to rest my report entirely on these data, I resolved to offer no opinion, till I had time to analyze and compare my results. I am not certain that this plan of proceeding was quite what the deputation most approved, but I feel convinced that it was the only way in which justice could be done to the inquiry, and confidence obtained for the decision."

The dimensions of a railway-bar to support any given *quiescent* load had become pretty well known, but practical men doubted and differed as to what was required by an engine and train *in motion*, whether more or less, and how much. Knowing that the results of theory, when opposed to their previous opinions, obtain little confidence from practical men, and would, therefore, be slighted by part at least of those for whose guidance the inquiry was undertaken, the Professor wisely resolved to found his Report on experiments alone; and these are happily such as may be repeated at any time, and at small expense, till the results from them are established beyond dispute. A horizontal lever, of which the arms were as 10 to 1, was mounted between centres on a plank; its short end was placed in contact with the under-side of the rail, and the other showed the deflection 10 times magnified. The effects produced by the passing engines and trains were minutely observed with this *deflectometer;* and several instruments were provided, and used at once, so as to show conveniently the effects produced on different parts of the bar and its supports, by the passing of the same load. Though some objections might be made to the manner in which it was used, and, consequently, to the arguments for rendering its indications comparable with those of former experiments, it is certain that it has already furnished important data, and that it will become one of the most indispensable instruments to the railway engineer. Its first trial produced the following lesson for railway managers, which surely will not be lost upon them:—

> "Our first experiments were only tentative, with a view to try the instrument, but even in these much was very distinctly shown; when, for example, a train passed over, we could see clearly the operation of each wheel upon the rail, which, where these were well laid, and the joints and blocks secure, were only of a certain amount; but when the rails were unlevel, or other irregularities occurred, some lurch would take place, towards the middle or end of the train, which would strike the rail with sufficient force to throw up the index to nearly double its previous amount, indicating, of course, that it had, in the case in question, sustained a deflection nearly double what it would have done with the same weight in a quiescent state."

Numerous and varied experiments with this instrument, while they indicate a small increase of deflection with increase of velocity, seem also to have ascertained that it is too small to need much addition to the strength of the rails; for on comparing these observations with those made at *Woolwich with quiescent* weights, it may be doubted whether, when allowance is made for the manner in which the deflectometer was used, any real excess of deflection was occasioned by the passing load. This, however, was not the case with the joint lengths, where the deflection was 40 per cent. additional; it is not suggested how this is to be prevented, but it is attributed partly to the looseness of the chair and block.

It seemed desirable to know, whether the deflection produced by *lateral* pressure on the outward rail in curves, required an addition to the strength of the rail in that direction; for this purpose a deflectometer was constructed of a somewhat different shape. The result however was, that rails sufficient for their work in other respects would not fail under this strain, so that the subject needed no further attention.

The deflectometer rendered very apparent the importance of placing the blocks in every case opposite to each other. Until this and other precautions are taken, the constructors of railways must be content to use rails very much heavier than the work of the road actually requires:—

> "In consequence of the imperfection of these parts (the blocks, &c.), a strain is occasionally thrown on the rail which produces a deflection about double that which belongs to the load in question. This effect was frequently and obviously exhibited in the experiments with the trains. In many cases, the deflectometer showed only the common amount of deflection when the engine (by far the heaviest load) passed over; whereas, perhaps in the middle, or at the end of the train, a waggon would lurch over from some irregularities, and throw up the index to double its former amount. This effect was very particularly noticed by the Deputation, Directors, Proprietors, and other parties present. It follows, therefore, that till greater perfection can be obtained in railways, a strength of bar more than double that due to the mean strain must be provided. In my former Report, I have allowed 50 per cent. beyond the double, as a surplus; but from these experiments, it appears this allowance is in excess, and that from 10 to 20 per cent. beyond the double will be sufficient; that is, for a 12-ton engine, as the weight is at present distributed, a strength of 7 tons would be an ample provision, and with greater accuracy of construction, such as the care now taken may be expected to ensure, a less strength would be sufficient; or rather, allowing the same strength, an engine of 14 or

> 16 tons might be passed over with the greatest confidence.
>
> "By referring to the observed results in the Appendix, it will be seen, that one rail is sometimes depressed by one wheel a quarter of an inch, while the other wheel is perhaps on a block; and immediately after the high wheel is depressed, and the lower wheel raised, giving thus a rocking motion to the carriages, the effect of which was rendered remarkably obvious by the little instrument employed. No doubt much of this is due to a want of parallelism in the bearing blocks; and therefore, as one step towards correction, I would recommend it to be made a special instruction, *that the blocks shall in every case be placed immediately opposite to each other*, which in parallel rails may always be effected without expense or inconvenience. Other corrections, however, are necessary, which will be noticed in their proper places."

Another branch of the subject is the length of bearing, and the consequent inquiries as to the sectional dimensions of the rail and stability of the blocks and chairs. Adopting the parallel rail, and rejecting the double-headed one, Professor Barlow determines from experience that the head of the rail ought not to have a less sectional area than 2¼ inches, that is, it should not weigh less than 22½lbs per yard, and that the entire depth must not exceed 5 inches. Commencing with these assumptions, he gives plans, computations, and tables for rails with bearings of the lengths of 3 feet, 3 feet 9 inches, 4, 5, and 6 feet, the sections being so arranged as to give the maximum strength.

In discussing the best sectional form of rail, Mr. Barlow makes an observation well worthy of remark:—

> "In the sections given in a preceding page for rails at different lengths of bearings, it will be seen that I have confined the breadth of the lower web to 1½, or, at most, to 1⅔, inches, and this has been done, although I am well aware that, to extend the breadth of the lower web, and to reduce its depth, would theoretically give the strongest rail; in fact, that the double T is, on paper, a stronger rail than the deep and less broad flanched rail, but I am quite convinced it is not so in practice. The lower web comes no other way into use than as it is brought into a state of tension by the action of the centre rib; and although the fibres of the lower web lying immediately below the centre rib are brought into action by it, and that these fibres excite *a similar action laterally* in those *immediately contiguous to* them, and these again to the next, and so on, yet in a ductile metal, like malleable iron, this lateral effect is soon lost; so that the extreme fibres of the extended lower flanch become inefficient.
>
> "To convince Mr. Locke, and some other gentlemen of the weakness of the double T form, I had one of the rails taken up, and ½ an inch cut away on each side from the lower flanch, reducing its breadth at the point of greatest strain, that is, in the middle of the bar, to 1½ instead of 2½ inches. It was then put into the press, and the strains brought on as usual, under the superintendence of Mr. Edward Woods and Mr. John Gray; Mr. Locke himself being obliged to leave just at the time the experiment was in progress.
>
> "Mr. Rathbone, Mr. Edward Cropper, and myself, were also present, and the result was, that the bar thus mutilated showed greater strength than the mean strength which Mr. Locke found to belong to it when whole. Now, although I am ready to grant that the bar was actually weakened, and that this apparent anomaly is attributable to the imperfection of the press, yet, on the other hand, it must be admitted that it could, with such a result, have lost but little of its strength, and that the iron thus abstracted, viz. nearly ⅕ of the whole section, if judiciously introduced elsewhere, would undoubtedly give a much stronger rail."

While we fully admit the importance of these remarks, we imagine they will require further illustration before they obtain general assent. What is the longitudinal form assumed by the extreme lateral fibres supposed to be so nearly ineffectual? If it be the same as that of their neighbour fibres toward the centre, it has required force to extend them—if it be nearer a straight line, they have hindered to some amount the extension of their fellows. Mr. Barlow does not hazard opinions lightly, and will probably on some future occasion give further reasons for the conclusion at which he has arrived.

In testing the stability of the blocks, the deflectometer again did good service. Though no great exactness was attained, it appeared that blocks, five feet asunder, sank as little under a passing load as those but three feet apart. Considerable difference of opinion seems to exist, as to the economy and propriety on other grounds, of the use of more or fewer blocks. The arguments on both sides are given; some of which seem to show that the Professor's help was by no means superfluous. He gives his own opinion in these words:—

> "The conclusion to which I am brought, as to the relative expense of maintenance per block in five feet and three feet bearings, or, more generally, in long and short bearings, after well weighing all these points, is, first, that in embankments, and where there is a soft sub-soil, the expense would be greater at first with the long bearings than with the short, but that it would ultimately become the same, although certainly never less; and, secondly, that on rocky, or very solid bottoms, the expense would be very nearly the same from first to last."

It can scarcely be doubted, that, while the earthen surface on which the block rests is new, it will be a little compressed permanently by every blow, and the number of blows being as the distance between block and block, it will be sooner compressed under long than under short bearings; but, as soon as it has become so hard as to return to its shape after the greatest blows to which it is liable, it is of little importance how often it is struck; that is, whether the bearings be long or short.

The form of chair he prefers is one which would admit a plain single T rail; but, as the rail he decidedly recommends has a bottom flanch, it is proposed, that, where the blocks fall, a protuberance shall be left on the middle rib, so as to fill up its thickness to a level with the perpendicular face of the bottom flanch. A rail is thus obtained which admits the use of a plain chair; but the adaptation of particular spots to the chair seems to bring on the same difficulty with respect to the placing of the blocks opposite to each other, as was found in the case of the fish-bellied rail. It seems possible to avoid it in either case by making the bearing places half an inch longer than the width of the chair. The reason given by some for preferring the fish-bellied rail, "that its weak neck allows it to follow a sinking chair," is certainly a curious specimen of engineering sagacity. The further observations on the best form of chair deserve careful attention.

The section on "the formation of the joints" opens very curiously:—

> "On carefully examining the joints of the rails on the Liverpool and Manchester line, I am disposed to estimate that about one in six of the plain butt joints are as perfect as can well be *desired, and that another* one in six *are as bad as bad workmanship* and negligence can make them; the remaining two-thirds varying in character between these two extremes."

Has this celebrated road produced its splendid effects, while one-half of its power has been wasted, and its cost of repair doubled by "bad workmanship and negligence?" What may not be hoped for when searching inquiries like the present shall have brought up railway furniture even to the present standard of decent workmanship?

After urging the necessity and attainableness of much greater accuracy, and stating that Government work is much better done, the report proceeds—

> "In the smaller shells, which are still considerably larger than the opening in a railway chair, and unquestionably much more difficult to cast, not more than a deviation of $\frac{1}{30}$th of an inch is allowed, and I can see no reason why the railway chairs, and the end of the rails, should not be submitted to at least as close a gauge. To enforce this accuracy may, perhaps, incur some present charge, but do not the wear and tear of the rails and engines incur a much larger constant expense of maintenance? I am sure it is unnecessary for me to urge this point upon those proprietors who witnessed, during the experiments, the concussion on the rail exhibited by the deflectometer, which, of course, produced a light concussion on the engine and carriages. The whole of these were, doubtless, due to irregularities, of which the want of parallelism of the blocks and bad joints were the principal. Some persons present attributed them in part to flat places in the wheel; but if there are flat places in the circumference of the wheel, to what are these attributable but to bad joints? To be convinced of this we have only to consider what must be the effect of a blow on a wheel supporting a load of 3 tons, and moving with a velocity of 30 or 32 miles per hour, when such a body meets the end of a rail rising $\frac{1}{8}$, or, perhaps, nearly $\frac{1}{4}$ of an inch above another; or when the joints are so open as to allow the wheel to fall from one upon the other, with all the impetus due to such velocity.
>
> "In order to arrive at some estimate of this effect, a bad or open joint was selected, the deflectometer applied to the block, and the shock measured by the instrument. The rail was then taken up and relaid, so as to make the joint as close as usual, leaving the opening at the other end, and the effect was again taken, when it was found that the bad joint increased the force of concussion full 50 per cent; that is, the engine had to sustain a shock from this circumstance one-half at

least greater than was due to a very common joint, and probably double what it would have had to sustain at a good one."

Thus we may add, that the same care which is required by the "scarcely-perceptible" but important curve in the bottom of Mr. Locke's chairs (p. 55) would certainly produce much better articles than those described as in use on the Liverpool and Manchester line.

The following is the summary which the Professor gives of his Report:—

"1st. I am of opinion, that as far as is consistent with the amount of the first outlay, it is desirable to increase the weight or section of the rails, and to decrease proportionally the number of bearing blocks.

"2d. That in cuttings and other places furnishing a good firm bearing, the present size of blocks is sufficient; viz. allowing for the intermediate blocks four feet, and for joint blocks five feet, while the bearing length does not exceed five feet; but that on embankments they will probably require to be proportionally increased in size. But I recommend this to be put to the test of actual experiment.

"3d. I am of opinion that the cost of maintenance will, in the former case, after a short time, be in proportion to the reduced number of blocks, but certainly not less.

"4th. I consider the double and equal flanched rail to be inferior, in strength and convenience of fixing, to that which is described and modified to suit different distances, in a preceding page.

"5th. I consider Mr. Sinclair's proposition for rendering the rail plain at its points of bearing, to be in every respect recommendable.

"6th. I am of opinion the form of chair, and method of fixing the rail in the chair, proposed by Mr. Stephenson, is as simple and efficient (adopting the plan of rolling of Mr. Sinclair) as can be desired.

"7th. Yielding, as I am always ready to do, to practical opinions, when they are found pretty generally to agree, I am disposed to think the present mode of fixing the chairs to the blocks, with a wooden plug and iron pin, is, from its simplicity and convenience, the most recommendable.

Lastly. I am strongly convinced that no change or modification of form will produce any essential improvement, till greater uniformity be enforced in the figure and dimensions of the rails and chairs, and greater attention paid to the parallelism of the blocks, and to a proper adjustment of the distances of the ends of the rails from each other to *allow for expansion and contraction.*"

Some important theoretical investigations follow the Report, which we cannot notice at present, further than to extract two important conclusions.

It is found, "that the sum of all the variable resistances to a load by the deflection of the bar over which it passes, is exactly half the resistance the load would experience in ascending a plane of the same half length, and whose height is equal to the central deflection of the same bar."

From the table-page 88, it seems that the increase of power required by the deflection of the bars, is nearly proportionate to the distance of the blocks; a fact which is certainly to be taken into account when determining the length of bearing.

The appendix details many experiments not given in the body of the report.

The whole forms a very valuable contribution to our knowledge on some of the most important subjects connected with the construction and management of railways. We cannot but hope, that the same profound mathematician and veteran experimentalist will be again engaged, in illustrating the theory and correcting the practice of this most influential of recent inventions.

* * *

LIFE, WORKS, AND CHARACTER OF LORD BACON.

When Lord Bacon bequeathed his "name and memory" to "men's charitable speeches," he must either have intended to leave on record one of the bitterest satires on human nature extant, or not have anticipated how much the history of this affecting legacy was destined to exemplify the little charity there is in the speeches of men at all times, and under all circumstances. Perhaps no individual so truly deserving the gratitude of all posterity has ever been more uncharitably dealt by. Long before the world was ripe enough in philosophy to be able to appreciate the services which Bacon has rendered to it, a clever but unscrupulous satirist had made his name familiar to the common ear, as

"The wisest, brightest, meanest of mankind":

a character as absurd as it is unjust, for wisdom in the superlative never yet co-existed with meanness in the same degree; and Bacon, though frail and a receiver of bribes to administer justice (it is allowed he never administered any thing else), in an age when such practices were common, was generous and profuse even to prodigality. But, though the world has since become somewhat wiser as well older, such is the strong hold which vulgar errors, whether clothed in rhyme or prose, take on the popular mind, that, with the great majority of readers, the father of experimental or inductive (that is to say of all true) philosophy enjoys, even to this day, no better reputation than Pope has conferred upon him. Cowley would have rescued poetry from the disgrace of libelling philosophy in the person of Bacon; for there is an ode by this melancholiest but honestest of poets, in which, with great truth and with admirable felicity of imagery, he describes Bacon as ascending "like Moses" the Mount Pisgah, that bounded the wilderness of human ignorance, and "from the mountain's top of his exalted wit" seeing and showing "the blest promised land;" but Cowley sung, in this instance, in an uncouth strain, which was no match for the harmonious numbers of Pope. Nor has the character of Bacon been defamed in "immortal verse" alone; for even amongst the philosophic few *(et tu quoque mi fili!)* who are accustomed to look deeper than jingling epigrams for materials of judgment, and who, from the congeniality of their pursuits and attainments, might have been expected to cherish with the profoundest reverence the memory of their great master, the voice of detraction, if not of calumny, has been heard, and it is to be feared but too quiescently listened to. Sir David Brewster, in a life which he has written of Bacon, has delivered it as his deliberate opinion, that the Bacon philosophy is, after all, wholly destitute of merit, and that it is quite a mistake to suppose that the progress of science was accelerated by its promulgation. And Dr. Thomson, in his Annals of Philosophy, not content with condemning the Baconian logic, protests that those who have had the greatest admiratian for it have been the very men from whom science has derived the least advantage.†

Prompted by a laudable desire to rescue the fame of Bacon from this accumulation of injustice, a practitioner at the same bar, to the ranks of which we are already indebted for the best edited collection of his works yet given to the world,* has produced the best popular sketch of their author's character which we have ever had the pleasure to peruse.† Nothing could be more judicious than the plan of this work, or more satisfactory than the manner of its execution. To those who are conversant with Lord Bacon's works, it is well known that his letters contain many most interesting notices, illustrative of his personal history. These Mr. Martin has assiduously collected, and weaving them into a narrative of his life, has thus imparted to it much of the nature and interest of autobiography. "Such letters as are written from wise men," Lord Bacon himself observes, "are, of all the words of man, in my judgment, the best, for they are more than orations and public speeches, and more advised than conferences or present speeches. They are the best instructions for history, and, to a diligent reader, the best histories in themselves." Mr. Martin has in like manner very happily managed to make the Baconian philosophy, as contained in Lord Bacon's published works, speak for itself. Not, however, by giving a mere naked abstract of these works, which would have presented little if any attraction to the general reader; but, by presenting the substance of them in a condensed yet popular form, and illustrating them, when necessary, by examples, drawn from those splendid discoveries in science which have been made since Bacon "pointed the way." To show, moreover, the fallacy of the opinion that the Baconian philosophy had no effect in accelerating the progress of these discoveries, Mr. Martin has brought together such a mass of testimony, some of it gleaned from extremely rare sources, and all of it of the highest authority, as must, we apprehend, set the question at rest for ever. "If," as he well observes, "Sir David Brewster's opinion be correct, there would have been no such testimonies to be found; but the truth is, they are so numerous and conclusive, that the difficulty has been, not where to find them, but which to select."

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† *Mr. Martin, the author of the work under review, thinks the writer of the paper here quoted "cannot* be Dr. Thomson.' We are informed, however, that Dr. T. openly avows himself to be the author.

* Montague, 12 vols. 8vo.

† Character of Lord Bacon, his Life and Works. By Thomas Martin, barrister-at-law. 12mo. pp. 367.

The great characteristics of Bacon's philosophy may be expressed in a few sentences. Contrary to all those who had gone before him, he taught that in every subject of inquiry, the first step is to collect such facts or phenomena as in any way relate to it—not only those which spontaneously offer themselves, but such as can be elicited by experiments. Having obtained an authentic and genuine collection of facts, described in simple and plain terms, the next step is to discover by analogy, or by comparing them with each other, what Bacon calls the *form* of the subject of inquiry, or, in other words, those laws of nature which appertain to it. Such are the leading features; but we must proceed to lay before our readers Bacon's principles a little more in detail:—

"Having, agreeably to the precepts of Bacon, brought together all ascertainable facts relative to the phenomenon whose form, i. e., cause, or law, is the object of inductive inquiry, we must begin with considering what things are to be *excluded* from the number of possible forms. After this process of exclusion is accomplished, we are then possessed of a group of affirmative facts falling under the same predicament, or class. This is the first step in the progress of induction; it contracts the range of research, and brings the true explanation of the case in question within narrower limits. Thus (to adopt the illustration adduced by Professor Playfair), if the quality which is the cause of transparency in bodies be the subject of inquiry, from the fact that the diamond is transparent, we immediately exclude rarity or porosity, as well as fluidity, because the diamond is a very solid and dense body.

"Negative or opposing instances, i. e., facts where the given quality is wanting, must also, says Bacon, be carefully examined; for they are equally instructive. If, for instance, we confine air with moistened iron-filings in a close vessel over water, its bulk will be diminished, owing to a portion of it having become combined with the iron in the form of rust; and, on examining the residual air, we shall find that it *cannot* support flame, or animal life. Hence, from this *negative or opposing fact*, we discover that the *cause of the support of* flame and animal life is to be sought for in that part of the air which the iron has abstracted—viz. oxygen.

"Comparative instances—viz., those which show the given quality in a certain order or scale of intensity, are likewise to be considered. This is the more necessary, because, unless the class of facts is particularly alluded to, we shall be apt to conclude that cases which differ only in the degree of intensity are distinguished by a real opposition of quality. Transparency and opacity, for example, would at first sight appear in direct opposition; but, on considering the gradual diminution of transparency in natural substances, we shall see reason (as Sir John Herschel observes) to admit that the latter quality, instead of being the *opposite* of the former, is only its *extreme lowest degree*.

"To render the affirmative, negative, and comparative facts more available, Lord Bacon suggests that a tabular arrangement of them should be adopted. It is in this part of the *Novum Organum* that the author proceeds to exemplify his inductive method with reference to heat.

"His collection of facts is allowed by Bacon's warmest admirers to be imperfect; yet, in the opinion of Professor Playfair—his ablest and most eloquent commentator—it is extremely judicious, and the whole disquisition is highly interesting."

In an earlier part of his work, Mr. Martin observes, that

"Bacon saw plainly, that if he had not other and better principles of procedure than those which guided the inquiries of philosophers, his map of the world of science would be of little avail; that, as Columbus would never have made those maritime discoveries which immortalise his name, without the aid of the magnetic needle, so, in philosophy, we should still be mere *coasters*—so to speak—confined to our own native shores, unless possessed of some instrument that would direct us to those undiscovered regions of knowledge which lay beyond our ken. With the philosophy of Aristotle, Bacon had long been dissatisfied; and even at college, when only about sixteen years of age (as he assured Dr. Rawley), he fell into a dislike of that system, finding it barren of works beneficial to man, and fruitful only in logomachy, 'in which mind,' says Rawley, 'he continued to his dying day.' To propound a better method of discovery—one that would purge philosophy from its errors, and enrich it with new truths—had long been a favourite and fixed purpose with Bacon; and having, after much meditation, matured and methodised his thoughts, he proposed his plan in the *Novum Organum*, 'with so much strength of argument,' says one of his most distinguished disciples, 'and so just a zeal, as renders that admirable work the delight of all those who have a taste for solid learning.' The grand and fruitful principle propounded by Bacon, and which is as universally applicable as the Aristotelian dictum *De omni et nullo*, and without which that dictum would be a barren and useless abstraction, is the principle of INDUCTION. To unfold this principle, to teach mankind that the *only* method of inquiry which can conduct to any useful result is that which, taking facts and not opinions, experience and not hypothesis, for its basis, proceeds, by means of rejections and conclusions (i. e. in the way of analysis) to decompose the phenomena of nature, so as to elicit those axioms or general laws (i. e. generalise facts) from which we may sympathetically infer not only the particulars already inducted or brought in for examination, but others of which we have no previous knowledge—to propound this procedure, with rules for conducting it aright, was the object, designed and realised in the *Novum Organum*, and by which Bacon acquired, and so justly merited, the title of founder or *Father of Experimental Philosophy*."

The above is a brief, but a very excellent outline of the principles of the inductive school of philosophy, as taught by Bacon. Mr. Martin says, that "it is true Bacon made no discoveries." Surely this must have been advanced unadvisedly. We should rather say he discovered every thing. Mr. Martin, indeed, adds, that, "with untiring zeal and fervid eloquence, he taught the method by which discoveries are made. He endeavoured (and most successfully) to withdraw science from the sterile philosophy of the schools, and pointed to the land of promise." With due submission to his able and zealous advocate, we venture to affirm that he did a great deal more. He was, in verity, the destroyer of the sterile philosophy—of the schools in which knowledge existed not—and was himself alone the creator of true science. He did not merely point to the land of promise, but he discovered it. He exhibited it openly to men's view in all its glories, and left others to take possession of it, and adapt its ample, its infinite resources to the promotion of the welfare and happiness of mankind.

Bacon was the true discoverer of the world of science. The most learned men of his own day acknowledged *this in so many words*, and the most illustrious philosophers of modern times have borne ample testimony to the fact. We care not for the depreciating remarks of mere experimentalists, who, by thus acting, only publish to the world their own want of knowledge, or want of honesty; nor do we regard the silence of those fraudulent philosophers who steal his thoughts, and, of course, do not acknowledge the theft.

Bacon's remarks on falling bodies, and his proposed experiments to determine whether their tendency downwards is the result of some peculiar mechanism in themselves, or of the attraction of the earth, show, that he had all *but* arrived at the same results with regard to gravitation which Newton did many years afterwards. He says, in effect, that if heavy bodies fall downward in consequence of the attraction of the earth, by the corporal mass thereof, as by a cohesion of bodies of the same nature, it will follow—

> "That the nearer all bodies approach to the earth, the stronger and with the greater force and velocity will they tend to it; but the farther they are, the weaker and slower. His experiment consists in taking two clocks, one moved by leaden weights, and the other by a spring; and, having set them together, carrying the first to the top of a high church, and leaving the spring clock below, so that we may then discover whether the former move slower. He suggests, also, that this clock should then be carried down to the bottom of some deep mine, in order to ascertain if its rate of going be accelerated. 'In short,' says Sir John Herschel, 'the principle of this experiment was the comparison of the effect of a spring with that of a weight, in producing certain motions in certain times, on heights and in mines. Now this,' he adds, 'is the very same thing that has really been done in the recent experiments of Professors Airy and Whewell in Dolcoath mine: a pendulum (a weight moved by gravity) has been compared with a chronometer's balance, moved and regulated by a spring.'"

The above would of itself be sufficient to convince us, that Newton studied Bacon, and was not only well acquainted with his writings, but derived great advantages from them. Some affect to deny this fact; but we have it upon the authority of Pemberton, in his "View of Newton's Philosophy," that Bacon's works were not only generally approved of by Sir Isaac, but that he and his illustrious friend had read a great part of them together.

The high estimation in which Bacon was held by his own countrymen may be further inferred from the fact, that the University of Oxford (after his ignominious sentence, and consequent utter loss of all political power) presented to him an address of thanks, in which he is represented as "a mighty Hercules, who had by his own hand further advanced those pillars in the learned world which by the rest of that world were supposed immoveable." This address does great honour to the *then* University of Oxford. Mr. Martin says,

> "It appears that, before the publication of the *Novum Organum*, the advancement of learning had been 'well tasted,' not only in our own universities, but in the English colleges abroad. 'Dr. Collins, provost of King's College, Cambridge, a man of no vulgar wit, affirmed unto me,' says Dr. Rawley, 'that, after reading the *Advancement of Learning*, he found himself in a case to begin his studies anew, and that he had lost all the time of studying before.' The testimonies of Ben Jonson and Sir Henry Wotton, two of the most learned and eminent men among Bacon's contemporaries, may likewise be adduced. 'The *Novum Organum*,' says Jonson, 'is not penetrated or understood by superficial men, who cannot get beyond nominals, but it really openeth all defects of knowledge whatsoever, and is a book,
>
> 'Qui longum noto scriptori proroget ævum.'"

Bacon, like most men of great and extraordinary merit as discoverers, was accused of Atheism, or rather of being the author of writings which had a tendency to make Atheists. Nothing can be more false. Bacon was himself evidently a sincere Christian:—

> "For the original source of such prejudices as these, we must look into that peculiar system of theoretic or speculative divinity which formerly prevailed. The scholastic philosophy, whose origin and character have recently been so ably and ingeniously investigated and explained by Dr. Hampden, was the acknowledged system of the church, and soon stamped its metaphysical character upon theology, which became the master science. The *Trivium* and *Quadrivium* of the schools were studied in subservience to this system; and all science having been incorporated with theology, the notion arose, that nothing could be true in any science that was not accordant with *the received interpretation* of the Scripture, *whether literal or hypothetical.*
>
> "'If the Scriptures,' says Sir Humphrey Davy, 'are to be literally interpreted, and systems of science found in them, Galileo merited his persecution, and we ought still to believe that the sun turns around the earth.' And we would add, that those who seek for systems of geology, for instance, in the Genesis of Moses, are not consistent with themselves, when they acknowledge (as all rational people do acknowledge), the truth of the Copernican system. In the one case, they are guided by a just rule of construction, which, in all others, they reject."

All this is ridiculous enough, but not a whit more so than to conclude, that because we cannot reconcile every discovery of science to supposed Scriptural dogmas, therefore, the Scriptures are untrue. Nothing is more common, now-a-days, than to hear would-be philosophers (of both sexes) decrying the Old Testament, because, forsooth, they cannot reconcile the Mosaic account of the creation to their smattering of geological knowledge. How different was the conduct of Bacon! "There is no enmity," he observes, "between God's word and his works. To seek heaven and earth in the word of God (whereof it is said, 'heaven and earth shall pass away, but my word shall not'), is to seek temporary things amongst eternal: and as to seek divinity in philosophy is to seek the living amongst the dead, so to seek philosophy in divinity is to seek the dead among the living. Neither are the pots or covers, whose place was in the outward part of the temple, to be sought in the holiest place of all, where the ark of the testimony was seated." And in another place he calls "inspired divinity the Sabbath and port of all men's labours and peregrinations."

With respect, again, to foreign nations, the testimony of Des Cartes and his biographer shows, that Bacon's writings were early and well-known amongst them:—

> "'While Des Cartes,' says Baillet, 'was in Paris in 1626, he heard of the death of Bacon. This news sensibly affected those who aspired to the re-establishment of true philosophy, and who knew that Bacon had been engaged in that great design for several years.' In 1631, Des Cartes visited London, and in 1633, he writes from his retreat in Holland to Father Mersenne in Paris, that 'if any one could be prevailed upon to undertake a history of the appearances of the heavenly bodies, according to the Veru-

> LAMIAN METHOD, without the admixture of hypothesis, such a work would prove of great utility;' and in another letter, he says, 'I have little to add respecting experiments to what Verulam has said.' Gassendi and Peiresc, two of the most eminent French philosophers of that day, and both friends and correspondents of Galileo, were among the earliest disciples of the English philosopher; and the former pronounces the reformation undertaken by Bacon a great and heroic enterprise."

We come now to that occurrence in Lord Bacon's life which called forth the epithet "meanest of mankind" from Pope, the eulogiser of the abandoned Bolingbroke:—

> "In 1617, he was made Lord Keeper; in 1618, Lord Chancellor; and two years afterwards, he published his great work, the *Novum Organum.* He had completed his sixtieth year, among troops of friends, emulous to do honour to one who was an honour to his country, and whose fame had gone out into all lands. If at this period of life Bacon had quitted all civil employment, and retired into the seclusion of Gorhambury, there to pursue his beloved philosophy,
>
> 'Exhausting thought,
> And hiving wisdom with each studious year,'
>
> he could have appeared to posterity, not only as the great ornament of his age and nation, but of human nature itself.
>
> "He, however, who had long run so brilliant a course, instead of sitting in splendour, suddenly fell from his high estate—was, by the judgment of his peers, degraded from office, heavily fined, and imprisoned in the Tower."

It is remarkable, that from the first bringing of the charge against Bacon, of which he was afterwards convicted on his own confession, he never altogether denied it; nay more, he never expressed a wish to defend his conduct, but, on the contrary, he declares, in his letter to the Lords, presented by Buckingham, that he should "use no cavillations, but plainly and ingenuously (as their lordships knew his manner was) declare what he knew or remembered." The charge against Bacon was simply this:—Disappointed suitors in the Court of Chancery alleged that he had received money from them previous to the decision of the causes in which they were engaged; and to this, as regards generalities, Bacon pleaded guilty. There can be no doubt that he was guilty of this most vicious practice, *which in those times* was as common as bribery and corruption have been, and perhaps are, in the present. The pretence for presenting gifts was the hastening of the judgment—not for the perverting it—and so far as Bacon was concerned, he merely complied with the terms of the pretence. He never perverted a single judgment:—

> "It should be observed, that, although Lord Bacon was punished for bribery and *corruption,* yet, if by corruption we mean the giving of unrighteous judgments, then assuredly (as Bacon most solemnly protested) he was not guilty of that crime. Soon after the appointment of Williams, Dean of Westminster, to be Lord Keeper, all the orders of his predecessors, supposed to have been corruptly made, were referred to him by the Parliament to be reviewed; and, after undergoing the severe scrutiny of one who undoubtedly was no friend to Bacon, and possibly his greatest enemy (for we strongly suspect that he counselled the King or Buckingham to compel Lord Bacon to abandon his defence, and make submission), yet we are assured by Rushworth—himself a barrister—that, 'though gifts rendered him suspected for injustice, yet never any decree made by him was reversed as unjust, as it has been observed by some knowing in our laws.' It is likewise affirmed by Aubrey (who may be considered a contemporary observer, for he was the friend of Hobbs), that 'his Lordship always gave judgment *secundum æquum et bonum.* His decrees in Chancery stand firm, and there are fewer of his decrees reversed than of any other Chancellor.'
>
> "We would formally observe, that Bacon suffered much from the exactions of certain of his secretaries and servants, who enriched themselves at the expense of their illustrious master, and his good name. This formed one of the articles of charge against him; to which he ingenuously replied, 'I confess it was a fault of neglect in me that I looked no better to my servants.' In allusion to this, when some of his servants rose up as he passed through his hall, he said, with that bitter pleasantry in which a breaking heart will sometimes seek relief, 'Sit down, my masters, your rise has been my fall!'"

Again:—

> "We ought not to estimate the crime of which Lord Bacon was convicted, by a standard inapplicable to the age in which he lived. 'It had been a practice,' says Carte, 'perhaps from the times that our kings had ceased to take money for the purchase of writs to sue in their courts, for the suitors to make presents to the judges who sat in them, either at New-year's tide, or when their causes were on the point of com-

ing to a hearing; it was a thing, of course, not considered in the nature of a bribe, being universally known, and deemed a usual or honorary perquisite.' In the course of Bacon's trial, Mr. Alford, an eminent member of the House of Commons, observed, 'that in the ledger-book of his family, there were entries of thirty shillings paid to a secretary, and ten pounds to a Lord Chancellor, for his pains in hearing a cause; and that, in his opinion, such gratuities were customary.' The extent of this practice of receiving presents, may be partly estimated by the following extract from Miss Aikin's account of the reign of Elizabeth; 'an authority,' says the writer from whom we borrow this quotation, 'the less suspicious, as that lady has exercised her gifts with great diligence against Lord Bacon:'—'The ministers of a sovereign who scrupled not to accept of bribes from parties engaged in law-suits, for the exertion of his own interest with the judges, would scarcely be expected to exhibit much delicacy on this head. In fact, the venality of the court of Elizabeth was so great, that no public character even appears to have professed a disdain of the influence of gifts and bribes.' "

The plain truth is, that Lord Bacon was not innocent of the vices of his times; and any one may call upon those who are, without any fear of being pelted to death, to throw the first stone. As Bacon himself justly observes, there are *vitia temporis*, vices of the times—and *vitia hominis*, vices of the man, or vices peculiar to the individual. It is clear, that Bacon was guilty of the former; but, to our minds, it is so far from being clear that he was guilty of the latter, that we believe that in all the higher virtues he was unsurpassed in any age, and immeasurably above his own.

After pleading generally "guilty," Lord Bacon presented a "humble submission and supplication" to the House, containing the following more explicit confession of the truth of the charges brought against him, and casting himself entirely on their "lordships' favour and commiseration:"—

"To pass from the motives of my heart whereof God is only judge, to the merits of my cause whereof your lordships are judges, under God and his lieutenant, I do understand there hath been heretofore expected from me some justification; and therefore I have chosen one only justification instead of all others, out of the justifications of Job. For after the clear submission and confession *which I shall now make* unto your lordships, I hope I may say and justify with Job in these words: I have not hid my sin as did Adam, nor concealed my faults in my bosom. This is the only justification which I will use.

"It resteth, therefore, that without fig-leaves, I do ingenuously confess and acknowledge that, having understood the particulars of the charge, not formally, from the House, but enough to inform my conscience and memory, I find matter sufficient and full, both to move me to desert the defence, and to move your lordships to condemn and censure me. Neither will I trouble your lordships by singling these particulars, which I think may fall off,

'Quid te exempta juvat spinis de pluribus una?'

Neither will I prompt your lordships to observe upon the proofs, where they come not home, or the scruples touching the credits of the witnesses: neither will I represent unto your lordships how far a defence might, in diverse things, extenuate the offence in respect of the time or manner of the gift, or the like circumstances; but only leave these things to spring out of your own noble thoughts and observations of the evidence and examinations themselves, and charitably to wind about the particulars of the charge here and there, as God shall put into your minds, and to submit myself wholly to your piety and grace."

Ample as this submission was (yet singularly dignified withal), it did not satisfy his judges. They required him to confess or deny the charges *seriatim*. With this order he in some sort complied, by stating frankly the facts connected with each charge, yet leaving the House to draw its own conclusions as to the measure of guilt which they involved. The Lords then sent a deputation of twelve of their number to him, who "showing him his confession, told him that the Upper House conceived it to be ingenuous and free, and demanded whether he had subscribed it." Upon which he said, "My lords, it is my act, my hand, my heart; I beseech your lordships be merciful to a broken reed."

What a melancholy spectacle is here presented to us! The most illustrious man of his age prostrate in the dust, beseeching the mercy of men, who, in wisdom, were to him as the dumb animal compared with speaking man, and who in mere honesty were, for the most part, if not altogether, vastly his inferiors!

We are free to confess, however, that true morality has gained much by what is called the fall of Bacon. Indeed, we venture to hazard the opinion, that the illustrious philosopher never appeared so great to the wise and virtuous as when, in the eyes of the general world, he was loaded with disgrace. What piety and candour is displayed in his confessions! How evidently sincere is his contrition! And how patriotic the feelings with which, in the following reflections on his fall, he anticipates the public good that may arise from it:—

"In the midst of a state of as great affliction as I think a mortal man can endure (honour being above life), I must profess of gladness in some things. The first is, that hereafter, the greatness of a judge or magistrate shall be no sanctuary or protector of guiltiness, which (in few words) is the beginning of a golden world. The next, that after this example, it is like that judges will fly from any thing that is in the likeness of corruption (though it were at a great distance) as from a serpent; which tendeth to the purging of the courts of justice, and the reducing them to their true honour and splendour; and in these two points God is my witness, that, *though it may be my fortune to be the anvil upon which these good effects are beaten and wrought, I take no small comfort.*"

The sentence passed upon Lord Bacon was in the following terms:—

"1. That the Lord Viscount St. Alban, Lord Chancellor of England, shall undergo fine and ransom of 40,000*l.*

"2. That he shall be imprisoned in the Tower during the King's pleasure.

"3. That he shall for ever be incapable of any office, or place, or employment in the State or Commonwealth.

"4. That he shall never sit in Parliament, nor come within the verge of the Court."

This severe sentence, to the credit of James I., bad as he was, was never carried into effect—at any rate, it was rendered almost nominal. He was confined only two days in the Tower; and was afterwards restored to his rights as a Peer of Parliament. He never, however, resumed his seat, but died as he had lived—in the cause of experimental philosophy and the best interests of mankind. His death is stated, in a recent popular publication, to have arisen from the bursting of a crucible; but the true cause, which was something very different, is given in the following extract:—

"In the spring of 1626, whilst taking the air in his coach in the neighbourhood of *Highgate, accompanied with* Dr. Witherborne, the King's physician, it suddenly occurred to Bacon—there being snow upon the ground—to try the experiment whether flesh could be preserved in snow. Accordingly, he and his companion forthwith alighted, went into a poor woman's house at the bottom of Highgate Hill, and bought a hen; and having made the woman exenterate it, they stuffed the body with snow, Lord Bacon himself assisting. The snow so chilled him, that he immediately fell extremely ill, and could not return to his lodgings at Gray's-Inn, but was carried to the Earl of Arundell's house at Highgate, and there put into a warmed bed, which is said, however, to have been damp, not having been used for a year before. * * * In a few days after Lord Bacon breathed his last."

"For my burial," said Lord Bacon in his last will, "I desire it to be in St. Michael's Church, St. Alban's; there was my Mother buried; and it is the parish-church of my manor-house of Gorhambury, and it is the only Christian church within the walls of Old Verulam. For my name and memory I leave it to men's charitable speeches, to foreign nations, and the next age."

"A legacy so splendid," says Mr. Martin, with equal eloquence and truth, "the world never before received. It is the *name* of one who was, emphatically, the minister and interpreter of Nature—the chosen instrument for communicating to mankind that knowledge which an awful Providence, whose ways are not our ways, had hitherto concealed from the sight of man. It is the *memory* of one who will never be forgotten whilst eloquence can be felt, philosophy understood, or wisdom revered."

THE MONSTER SPECIFICATION—FURTHER REMARKS.

A brief analysis of the first head of this specification, may serve as a sample of Mr. Farey's style. It commences with a very elaborate and lengthy description of the structure of *common* bobbin-net, for the purpose of introducing that of the altered direction of the carriage threads. Next comes a declaration, that an invention, similar to that about to be described, has already been patented, as applied to other kinds of bobbin-net machines. Then follows a very particular account of the cloth work to be produced, and a general statement of the means by which it is to be made. After this is a very lengthy description of the machinery to be patented, referring, if we remember right, to nine sheets of drawings, in which descriptions and drawings very many old and well-known parts of the pusher machine are delineated with the same elaborate minuteness as those peculiar to the invention. The whole is concluded by a most exact account of every motion of the machine, and every position of the threads during the entire course!

The same course, or nearly so, is followed in most of the other articles. The cut of wheels, and the exact shape of the several cams, are given in full size, or on a very large scale in the drawings; and the descriptions descend so much to particulars, as to give the number of teeth in many of the wheels, and the number they move each time. Perhaps the most remarkable passage is one in the second article, where there occurs a description of the fluted roller machine, occupying about twenty folios, followed by this declaration, or one to the same effect:—"So far is a description of the fluted-roller machine *in general use:* I now proceed to describe the alterations in it necessary to produce the before-mentioned effect."

The concluding part of the specification is not less verbose than the rest. For instance, after claiming, in very diffuse terms, the invention specified in the second article, the very same words, changing only the name of the machine, are used; again, in the third article, in all their lengthiness to claim the application of it to another machine; and again, without omission or contraction, in the fourth. The *claim* alone of the nine articles occupies, altogether, two closely-written skins.

In making these remarks, we have not the slightest intention of impugning the professional ability of the respectable engineer who drew the specification—our quarrel is mainly with the law.

It is necessary to bear in mind, that a law of patents, and the administration of that law, to be good for any thing, must accomplish at least two purposes; it must secure to the inventor his rightful property in his in*vention, without danger of successful infringement;* and it must warn all others from trespassing on his right, without restraining them further than his right extends. If it fail in the first, it leaves the best benefactors of their country to be robbed of their undoubted rights; if, in the second, it renders the protection of the inventor, oppression and robbery to all beside. Let us see how the law has worked in the present instance.

The stamp duty on patents is so regulated as to be proportionately less on a long specification than on a short one; and, what is worse, the fees are as large for that which fills but one skin, as for one which occupies a hundred. On the score of economy, then, there is a strong inducement to include many inventions in one patent. If fraud or concealment were intended (which we are very far from insinuating in the present instance), it could not be better attempted than by a long and intricate specification. Before it was altered by the late enactment, the law, bad as it was in other respects, accidentally put a "prudential check" on this practice, by invalidating the whole patent on the upsetting of any one of its parts; but now each count bears only its own risk: it cannot be told how long, how prolix, or how mischievously comprehensive they may become.

In every manufacture—and particularly in that of bobbin-net—there are many persons far, indeed, from wealthy, but ingenious, ardent, and persevering, whose inventive powers are very likely to be exerted on subjects akin to some already patented; while, from the nature of the machinery, it is not less likely that their plans may differ essentially from those of their predecessors. But how is an inventor to ascertain whether he is or is not following a path already trodden? No agent can inspect for him a specification like this to any purpose, for only those who are intimately acquainted with this kind of machinery, have the slightest chance of carrying away a single idea from the perusal; even his own examination of it, supposing him to have travelled from Nottingham or Devonshire for the purpose, would benefit him little as to the points on which he would need to be informed, when he has to struggle through the mass of intricacies collected here; and it should be remembered he must take no notes. He must then either abandon his project, risk the expense of perfecting, and the danger of working a re-invention, or give 38*l.* 16s. 8d. for a copy of the specification, and 100*l.* for that of the drawings! These obstructions meet the inventor of small means just at the most anxious and the most helpless period of his efforts; when the nascent scheme most exalts his own hopes, and induces the largest expenditure of his own resources, but is not mature enough to gain the confidence and the aid of others. Just then the full information the law ought to afford him at easy cost would be invaluable; it would become either a warning if he were forestalled, or a little to help and countenance if he were not. But it is refused him, except at a cost far above his means. Perchance he struggles on, supported by the sanguine hope of an inventor, to find at last that, in some huge dust-covered roll, lurks his sentence of poverty and disappointment.

A peculiarity in the bobbin-net trade greatly aggravates this wrong. Plain bobbin net is made by several different kinds of machines: the circular bolt or comb machine; the rotary machine, with single-bladed lockers, the fluted roller, the levers. the pusher, the traverse warp machines, and, perhaps, some others. Now each owner and workman devotes his means and attention chiefly to some one of these different machines, and all his plans of improvement refer to it. Let us suppose he thinks he can make clothwork on the pusher machine, before he can know whether he is infringing Mr. Croft's right or not, he must pay for copies of that gentleman's other eight inventions; of which, be it observed, one only refers to the kind of machine in which this unfortunate inventor is interested. Many is the honest and clever man, within our own knowledge, who must consign his plans to darkness, however original and meritorious, rather than incur such risk on one hand, or such expense on the other.

Neither does a specification like this serve any better for the protection of the patenting inventor. Describing and claiming many hundreds of new parts (to say nothing of the needless and circumlocutory description of old ones); it is morally impossible it should not include *many which are not* the *bona-fide* inventions of Mr. Crofts. Whoever has superintended the construction of a new machine, knows well that, though its peculiar principle may be unquestionably due to the professed inventor, many of the subordinate, though important arrangements, are usually suggested by the workmen. Now, we do not say that the inventor is not morally entitled to the best services of those he employs, and to all the profits and consequences of those services; but we do say that a specification so lengthy and so ridiculously minute as this is, necessarily endangers the patentee's legal right, by including much, which, though morally, is not legally, his.

On another ground we take grave exception to specifications like this. The machinery employed in the manufacture of webs of every kind, from blondnet to loop-sacking, is becoming gradually more complex; for, though simplified amazingly, as far as relates to the production of any one effect, the effects themselves required by public taste or convenience, are becoming daily more numerous, and are daily saddling the plain machine with contrivances of increasing elaborateness and delicacy. In the present state of the lace-machine, Mr. F. judges it necessary to figure and define many parts as well known to the trade as a cart or a gate is to a farmer; nay, if our memory deceives us not the common fast and loose pulley is honoured with two long lines of verbiage, though it may be found, under its above-mentioned popular name, in books twenty years old, at least. Now, let us imagine that, in a few years, the plans now patented have become familiar to the trade, that new devices are added to them, and Mr. Farey is called upon to specify. Will he, then, think it necessary to re describe these *then* old contrivances with the same minuteness he has lavished in the present instance on those now old? If he does, then, indeed, the present document, enormous as it is, is but a very moderate precursor of those we may expect; if he does not, then every reason for such a decision equally condemns his present practice.

It is, indeed, not wonderful that the patent law, originated without principle, and proceeding only by blunders, should involve even well-meaning men in absurdities, which bring on them the suspicion of caring most for the weight of their professional gains. Founded (if, indeed, it be founded at all,) on essential error, requiring the fulfilment of contradictory conditions, and altogether unsuited to the present state of the useful arts, it presents to the honest only a tissue of perplexities and dangers, while it affords to the designing an ample pretence and an effectual cover for private injustice and professional rapacity.

It is not for us to allot between Mr. F. and the law their respective shares in the monstrosity of this notable specification. A law which cared as it ought to do for the interests involved in this subject, interests vital to the well-being of the community, would certainly, as it might easily, provide against an abuse like this; while even the mischiefs consequent on the present law might as certainly, in this case, have been greatly diminished, had Mr. F. been less inattentive to the amount to which he was swelling his client's costs.

DOUBLE-LIFTING GASOMETERS.

Sir,—In your last Saturday's Number, there is a description of what is termed a "Double-lifting gasometer," said to be the invention of Mr. Stephen Hutchison. If there be any merit in the invention, I believe Mr. Hutchison must allow me to lay claim to a priority of right to it.

In *The London Journal of Arts and Sciences*, for June, 1824, p. 305, will be found a rough representation, in outline, on a small scale, and a description of a gasometer, exactly similar in all its essentials to that claimed by Mr. Hutchison as his invention. A few short extracts from this will fully substantiate my claim:—

"TAIT'S IMPROVED GASOMETERS.—The gasometers employed in storing up gas, until required for use, occupy, upon the old plan, much space, and are attended with considerable expense in erecting. The water-tank, whether sunk in the ground or raised, must be at least of equal dimensions with the gasometer, both in breadth and depth. The improved construction, which we are about to explain, affords a means of reducing the depth of the tank; dispensing with the bridge of suspension; and of increasing, at pleasure, the capacity of the gasometer upon a given base, thus rendering a small apparatus capable, if required, of holding a large quantity of gas, the first cost of which will *be considerably less than* a small gasometer, *constructed upon the ordinary plan.*

"Mr. Tait, of Mile-End-road, the inventor, has, we believe, been for some years connected with gas-establishments, and is therefore fully aware of the practical defects or advantages of the different constructions of gasometers now in use. Plate xvi., fig. 8, is a section of his improved contrivance; *a a* is the tank, and so on. * * * * *

"The gasometer is formed by several cylinders, sliding one within the other, as the tubes of a telescope; and so on. * * * Round the lower edge of this cylinder a groove is formed, and as it rises, the edge takes hold of the top rim of the cylinder *f*, which is overlapped for that purpose. The groove at bottom of the first cylinder fills with water as it ascends, and by the rim of the second cylinder falling into it, an air-tight hydraulic joint is produced.

"Thus several cylinders may be adapted to act in a small tank of water, by sliding one within the other with lapped edges, forming hydraulic joints; and by supporting the apparatus in the way shown, the centre of gravity will always be below the points of suspension. A gasometer may be made, upon this plan, of any diameter, as there will be no need of a bridge to support it," &c. &c.

In the works which I erected almost immediately after this publication, I introduced the same method of suspending the gasometer; with this difference, that instead of suspending it from about one-third from the top, as represented in the plate, I fixed the suspending chains to the upper rim of the gasometer: a method which, I believe, has been since that time almost invariably adopted, with, on some occasions, triangular beams across the top; an addition which I have not found to be at all necessary. The method which I had represented of suspending at some distance below the upper edge of the gasometer, was evidently optional, and was merely so represented for the purpose of showing what could be done to avoid the inconvenience of carrying the columns to the extreme height of the gasometers; and is perfectly practicable.

I am, Sir,
Your most obedient servant,
W. TAIT.

Feb. 1, 1836.

SYMINGTON'S PADDLE-WHEEL.

Sir,—The disinterested manner in which you supported my father's claim to the invention of steam-navigation, the favourable opinion you were pleased to express of my paddle-wheel, and your intimate knowledge of mechanics, induce me to request you to insert in your valuable Journal the following challenge to Mr. Galloway:—

I propose that a boat, selected for the purpose, shall be tried first with a pair of the common wheels, next with a pair of Mr. Galloway's, and afterwards with a pair of mine. The expense to be defrayed by the unsuccessful competitor; each party depositing with an impartial third person, before the commencement of proceedings, 150*l.* for that purpose.

By such a mode of comparing the value of our respective wheels, the question of superiority will be fairly set at rest; and the time and capital of such spirited individuals as take pleasure in forwarding inventions likely to prove beneficial, will not be misapplied.

Mr. Galloway having taken upon himself the office of an instructor in mechanics by publishing his "History of the Steam-Engine," he will surely feel no hesitation in informing me by what law of mechanics he is authorised to expect an increase of power from the present form of his wheel; or whether he does not himself believe, that instead of power being gained, a loss of power is sustained.

Admiring the liberality and enterprise of the steam-boat proprietors in Liverpool, it is my intention to be there in a few days with a model of my invention, when I have no doubt I shall be able clearly to demonstrate the advantages it possesses over every other wheel of the present day.

In conclusion, I have to assure you, that the William Symington steam tow-boat, a vessel of rather greater magnitude than Mr. Galloway's "Monarch," has been working with good effect on the Thames for the last fortnight; and that the wheels have been pronounced better, and are likely to be adopted by numerous steam-boat owners, who have had ample opportunities of judging of its value.

Assuring Mr. Galloway that I have no wish to detract from his mechanical skill, that all I want is fair competition, and that I am perfectly ready to abide the issue.

Your most obedient servant,
WILLIAM SYMINGTON.

Feb. 3, 1836.

THE HERAPATHIAN CONTROVERSY.

Sir,—I have read with much interest the letters on both sides of the question, as to velocity on railways, the principal writers on which are Mr. Herapath and Iver M'Iver; and I cannot help thinking, that the former gentleman has been rather unfairly treated by his opponents. For instance, no sooner does a letter appear under any signature whatever, in support of Mr. Herapath's views, than his assailants instantly, and without deigning to give the shadow of a proof, attribute its production to Mr. H. himself. I do not see, for my own part, why the same trick might not be played off on the other side; and perhaps it might not be so very far from the truth, if it were to be at once asserted that, were the anonymous mask in which, with the usual caution of Italian bravos, Mr. Herapath's enemies are enveloped, to be torn from their brows, it would be found, that Iver M'Iver, and his numerous backers, S.Y., H., Miso-philo-anti H., F. Meredith, &c., are one and the same individual.* They are all birds of the same feather, and all display the same eagerness to carp at the excellence they reach. It is at least quite as probable that the great Iver M'Iver is his own trumpeter, as that Mr. Herapath is his, or even more so, when it is considered that an anonymous writer may be expected to be not quite so scrupulous as one who appends his name and address to his communications.

Iver M'Iver asserts, as his echo, Mr. Meredith did, a week before him, that Mr. Herapath (as they assume A Looker-on to be), must be in the wrong, when he exposed the fallacy of Iver's theorem, since that theorem has not yet been promulgated. Now, I would ask, did not this valiant Highlander, when he first demolished, as he thought, Mr. Herapath's calculations, profess to show in what manner, and how much, he was out in his reckoning; and if so, let me ask the whole *multum in parvo*, how could he possibly do this, without producing a theorem, which he contended to be correct? A plain answer to this plain question will go farther towards settling the point in dispute, than whole reams of mere disputation, or a thousand groundless charges of writing under more signatures than one.

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* This supposition we know to be quite erroneous.—ED. M. M.

Mr. Meredith, of Cambridge, as he signs himself, is very severe on Mr. Herapath for not making good the challenge given by Philo-anti-H., some time ago. In reply, I might inquire for what reason Mr. H. is to be held accountable for the rashness of every injudicious friend. You also, Mr. Editor, in some measure, join in the attack, by observing—" no answer has been received certainly;" yet allow me to ask, whether if Mr. Herapath's friends have been asserting that that gentleman, some time ago, sent a full vindication to the *Mechanics' Magazine*, which the editor refused to print, they have been asserting a falsehood.*

Although the pages of the *Mechanics' Magazine* have been chiefly open to one side only, on the question† at issue, between Mr. Herapath and his opponent, I hope this note will find a place in its next number, on the ground of its long reputation for impartiality.

And I remain, Sir,

Your most obedient, humble servant,

William Cooper.

No. 17, King-street, Feb. 3, 1836.

IVER M'IVER'S TABLE OF VELOCITIES.

Sir,—I find I wronged Iver M'Iver when I charged him with having given incorrect velocities in his table in No. 640, and I fully acknowledge it and express my regret for the occurrence.

I beg to explain how I came to make this mistake. When I saw Iver M'Iver's table, the velocities struck me as being very low, and I determined to examine them, and for this purpose referred to " Dr. Gregory's Mathematics for Practical Men:" on p. 238 of that work are the following equations:—

$$v = g t \sin. i = \sqrt{2 g S \sin. i}$$

$$v = V + g t \sin. i$$

Now, as $\sqrt{2 g S \sin. i} = g t \sin. i$, I at once substituted the one for the other, and did not perceive the error I had been led into until I considered the nature of the question.

Yours, &c.

S. Y.

Feb. 3, 1836.

RAILWAY TUNNELS.

(From Mr. Gibbs' Report upon the several proposed Lines for a Brighton Railway.)

An objection has been made generally to all tunnels—namely, that the air contained in them will be so contaminated by the noxious gas produced by the locomotive-engines in passing through them, as to render it unfit for respiration. Whether this objection has ever been advanced, or at all supported, by any scientific man possessing sufficient chemical knowledge to enable him to judge correctly on the subject, is doubtful. The probability, however, is, that the fear of any injurious effects from foul air has originated in those who have witnessed the effects produced by steam-engines in passing through the small tunnels on some of our canals; and if they have for a moment imagined that any similarity will be found in the effects in the two cases, their fears are quite justifiable. The tunnels on canals are commonly constructed of such limited dimensions, that it would be highly dangerous to attempt the same application of steam power as will be necessary on a railway; for instance, in the tunnel constructed by Mr. Telford on the Hare Castle Canal, the area above the water in the canal is only about one hundred feet; and even the Thames and Medway, in transverse dimensions, perhaps the largest canal tunnel in England, has only an area of four hundred and fifty feet; while the smallest tunnel contemplated on the Brighton Railway, will have an area of at least six hundred feet.

In order to explain to what extent the air in a tunnel is contaminated by a locomotive-engine passing through it, let us suppose a tunnel one mile in length to be traversed by a locomotive-engine, and its train of a gross weight of one hundred tons. The experience of the Liverpool and Manchester Railway has shown that the average consumption of coke is considerably less than half a pound per ton for each mile it is carried on a railway; but taking the consumption at half a pound, the whole weight of one hundred tons will require the consumption of 50lbs. of coke. It may be calculated that every 10lbs. of coke will evaporate a cubic foot of water; so that the whole 50lbs. will convert into steam 5 cubic feet of water in the distance of 1 mile. Now to convert into steam one cubic foot of water, requires 1,950, or say 2,000 cubic feet of air, then 5 feet of water will of course require 10,000 feet; and this will be the whole amount of contaminated air in one mile in length of tunnel. To determine the proportion of such an amount of foul air, and the whole air contained in the tunnel, we may take for example a moderate-sized tunnel 30 feet high, and having an area of 800 square feet. One mile in length of such a tunnel will contain 4,224,000 cubic feet; hence the contaminated air will bear to the whole quantity in the tunnel the ratio of 10,000 to 4,224,000; or it will be as 1 to 422. It will scarcely after this appear that any valid objection to tunnels, to assert that an injurious effect must result from the contaminated air, when we find that the quantity of this description of air, produced by the passing of the whole train, will be no more than $\frac{1}{422}$ part of the whole quantity in the tunnel.

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* *Yes; a gross falsehood.—Ed. M. M.*

† *Not true; they have been equally open to both sides.—Ed. M. M.*

Let us then venture to hope, that any prejudices which may now exist against the construction of tunnels upon railways will be dispelled, when we find that no injurious consequences will ever result from the foul air, or any other of the numerous evils which have been so forcibly dwelt upon by those who affect to perceive the most unhappy consequences from their adoption.

EXPERIMENTS TO ASCERTAIN THE EXISTENCE OF LEAD IN THE ATMOSPHERE OF A WHITE LEAD MANUFACTORY. BY MR. ARTHUR DUNN.

(From the London and Edinburgh Phil. Mag.)

Having witnessed at my manufactory the frightful effects of white lead on the workmen employed, I was anxious to determine if it was possible for lead to exist in the atmosphere, and through that medium, be absorbed into the system by the action of the lungs. For this purpose I made the following experiment, which certainly is important to the *manufacturer, as it points* out a serious evil to be guarded against. I shall now merely confine myself to the results obtained, and leave to some of your more scientific friends any theoretical reasoning or practical hints the experiment may suggest, provided you consider it worthy to occupy a space in your valuable magazine :—

An evaporating dish, containing about twenty-eight pounds of moist carbonate of lead, was placed in a sand-bath, and heated to about the same temperature as the drying-stove commonly used, never exceeding 150° Fahrenheit; over this was fixed, at the distance of from eight to twelve inches, a pair of common bellows, with a glass tube attached to the pipe, which pipe was introduced into a green glass bottle, containing twelve ounces of distilled water, acidulated with two drachms of nitric acid. The apparatus being thus arranged, the bellows were set in action, by which means the atmosphere, loaded with the moisture from the lead, was made to pass in a continued current through the liquid; this was continued for six hours. The whole was then transferred into a platina dish, and evaporated to perfect dryness. The residue was dissolved in one ounce of distilled water, with two drops of nitric acid, to insure the solution of the lead, should any be present. A current of sulphuretted hydrogen was next passed through the solution, which immediately gave a minute dark precipitate; this being collected on a filter, and washed, was transferred to a watch-glass, and treated in the usual manner with nitric acid to decompose the sulphuret, which gave, on the application of hydriodate of potash, the most unequivocal proof of the presence of lead.

Another experiment was conducted at the same time, with similar vessels, in the same room, but the current of air was not passed through the liquid. This, on the application of sulphuretted hydrogen, gave not the least indication of lead; but, on evaporating the whole to dryness, and treating the residue, in the manner before described, with hydriodate of potash, the slightest possible trace of the yellow iodine of lead was perceptible. The nitric acid and distilled water were separately tested with great care, but were found perfectly free from lead, so that, no doubt, the trace of lead must have been absorbed from the atmosphere, as the bottle containing it stood beside the one through which the current of air was passed. I ought to have mentioned before, that the temperature of the laboratory during the experiment, was from 70° to 80° Fahrenheit, and that the door was kept closely shut, that the air might be loaded as much as possible with the vapour.

EASY METHOD OF FILLING LONG SYPHON TUBES. BY WILLIAM FOSTER, ESQ.

(From Silliman's American Journal.)

The application of the syphon upon a large scale, for the purpose of drawing water from distant places, may not be new; but I do not remember to have seen it in this, or any other country, before I tried the experiment. The ancients, we know, brought water for the supply of their cities, by means of costly aqueducts, over hills and valleys, without ever using the fountain principle.

Some years ago Mr. Chapman, proprietor of a distillery in Charlestown, requested me to describe my plan for carrying water through a syphon several hundred feet in length, and drawing water from one well into another; and with the instruction I gave him, he employed a plumber to lay a leaden tube of three-quarter inch bore, from a well twenty-five feet deep, several hundred feet distant from the well of his distillery, which was about thirty feet deep, and where he wanted a greater supply of water.

The operation failed. He then came to me, and told me that I had led him into an expensive error. I told him that, had he communicated to me his intentions, I would, with great pleasure, have superintended the work; but now, not knowing what defects there might be in the tube, I could not answer for his success. However, I consented to assist him, but my first essay was unsuccessful.

The power of the syphon to overcome an eminence is limited to about thirty-two feet, answering to the column of water which the pressure of the atmosphere can raise; or that any defect in the syphon, or any air confined in it, would be fatal to its operation. The usual mode of charging a syphon is by exhausting it partially by inspiration at the longer end. But this was not possible with a tube several hundred feet long, and the expense of a pneumatic apparatus, to procure a vacuum, would have been too great; therefore, I had determined to put it in operation by filling it with water, both ends being stopped; this was done by a small branch at the summit of the tube; and, when filled, this branch was well corked, and the cork pressed down hard on the water, so as to exclude all the air at the surface. It was to be apprehended that some undulations might exist in the horizontal part of the tube, and afford a receptacle for air, which would there be confined without a possibility of escaping, and also prove fatal to the success of the experiment; but of this I could know nothing, as I had not seen the tube laid.

In this state of uncertainty, I began the operation, and filled the syphon; but, as I said before, it failed. On the second trial, I observed that, when the syphon was full, the water in the filling branch rose and fell alternately, and so much, that as water has but little elasticity, I concluded that there was air in the tube, and it was, therefore, emptied. Then, to charge it anew, and, at the same time, to exclude the air, it was proposed to perforate the lower end of the long branch, at the bottom of the receiving well, with a fork, just above the cork which closed it. These small holes allowed the air to escape as it was driven before the water, without losing enough water to prevent the filling the tube with ease. Thus was the air excluded, and the syphon put into operation, and continued for a long time, with some occasional obstruction, arising from the smallness of the tube, and the want of water at the source.

I should suppose that there were many situations where water might be brought from one valley to another, over any hill not exceeding thirty-two feet, or which could, without too much expense, be reduced to that point, for the purposes of irrigation, or manufacturing. Large quantities of water, as well as small, may be raised by means of iron mains of large dimensions; and the cutting down hills to procure levels, or surrounding them, and thus increasing the length of aqueducts, at a great expense, and loss of water by percolation and evaporation, may be avoided. Mountain swamps may be drained, or any swamps, where a lower level is not too far distant for the place of issue, or even in a level country, provided some vein of loose gravel can be found, into which a place of discharge may be dug below the surface of the swamp. The ingenuity of our countrymen will, I am confident, yet find many other useful purposes to which the principle may be applied.

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NOTES AND NOTICES.

Architectural Prize.—The honorary premium of the Institute of British Architects, for the best essay on "Concrete," has been awarded to Mr. George Godwin, junior, architect, of Brompton.

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price 6d. Also, the volume complete, in boards, price 9s. 6d.

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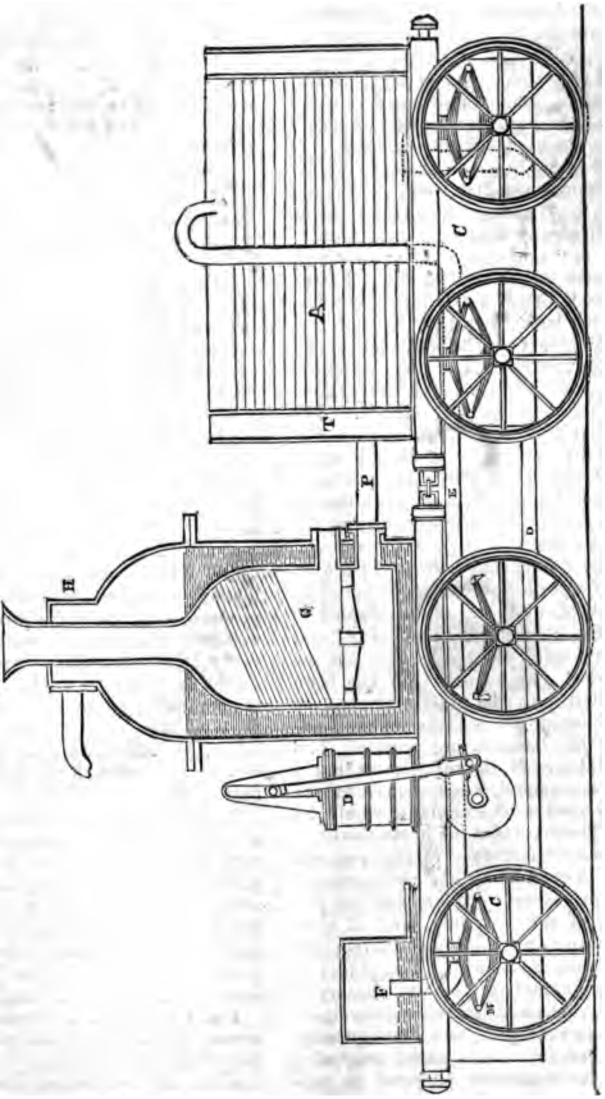


NICKOLL'S PATENT RAILWAY CONDENSING-LOCOMOTIVE.

DESCRIPTION OF NICKOLL'S PATENT CONDENSING-STEAM FIRE-ENGINE AND RAILWAY CONDENSING-LOCOMOTIVE.

(Communicated by the Inventor.)

The distinguishing feature of these inventions consists of an apparatus for cooling the water that has been heated in, or by, the condenser of a portable condensing steam-engine. The apparatus in question, *alias* the refrigerator, is constructed of several series of layers of any kind of cloth, or metal, arranged on metal wires or rods, horizontally, and at such a distance apart, one above the other, that currents of air from the surrounding atmosphere may pass freely and continually through and among its various strata. The refrigerator may in some cases be open to the wind on all sides; or it may be enclosed in a box or carriage, having an induction and eduction air-chamber, perforated with numerous apertures to effect a more equal distribution of the air in the refrigerator, with or without a pipe to conduct the air and vapour from the refrigerator to the furnace. The water that it is intended to cool, is discharged by the engine upon the upper layer of the refrigerator; from whence descending by its gravity through the inferior layers of the refrigerator to the cold-water reservoir, it (*i. e.* the remainder of the water) suffers from the evaporation of a portion such a reduction of its temperature, as to be again adapted to supply the condenser. The refrigerator must be made very rough, and not too porous, lest the water which has been transmitted into the refrigerator to be cooled should not be long enough exposed to the refrigerating process. The superficial area of the refrigerator that I should recommend, when a smart breeze could be always at command, would be about 100 square feet per horse-power.

The second feature of these inventions consists in connecting the piston-rods of two steam engine cylinders and the piston-rods of the air-pump, and of such other pump or pumps as may be required to the same cross-head. The object of this arrangement of steam-machinery is to render condensing steam-engines lighter, and more compact, and, consequently, more suited for various useful purposes; to wit, for locomotive purposes on railways, in working fire-engines, and in *propelling vessels, &c.*, the power, in the case of steam-vessels, being immediately applied, through the medium of two forked connecting-rods, to two cranks on the shaft of the paddle-wheels. Now, as in the descending stroke, with the present arrangement of the steam-engine, the weight of the pistons, rods, and cross-head, would occasion a very great momentum, the air-pump is made to perform its greatest labour in the descending stroke; *i. e.* the air-pump, as used solely to exhaust the condenser, ejects in its descending stroke the principal part of its hot water; its piston being furnished with one or two very small valves, merely to permit the passage of the incondensible gas, and a small quantity of the hot water above the piston, to be ejected at the upward stroke of the air-pump into the main ejection-pipe. But in the construction of my portable condensing steam-engines, as used in extinguishing fires and for some other purposes, I make the air-pump not only to exhaust the condenser, but also to operate as an ordinary suction and force pump; *i. e.* it has a solid piston, and is supplied from the condenser, as in the diagram, fig. 2, at the aperture A, through the medium of a pipe B, which, from the action of the pump, is alternately above or below the level of the water in the condenser C; and which pipe B, consequently, alternately admits the incondensible gas, or hot water of the condenser, into the air-pump D. E, the hot water and incondensible gas ejection-pipe of the air-pump D, terminating in the air-vessel F. R, the suction-pipe, by which water that is acted on by atmospheric pressure enters at the base of the air-pump D; this water, by the descending stroke of the air-pump, is ejected through G into the base of the air-vessel F.

To work the steam-valves of my portable condensing-steam fire-engine, I connect the rods of the two ordinary slide-valves to the same cross-head K (see side-view, fig. 3). K is connected by the rod L to the oscillating-lever M, externally to the carriage-floor N; and the lever M is worked by the tappet-rod O from the engine's cross-head P.

Fig. 1 represents a section of a railway condensing locomotive steam-engine, with the refrigerator A, placed in that part of the ordinary locomotive tender which at present constitutes the reservoir. T T are the air induction and eduction passages.

Fig. 2.

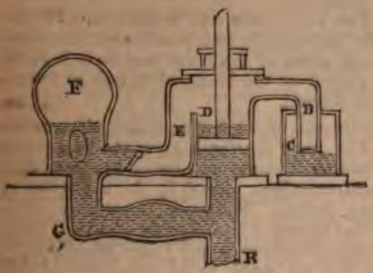
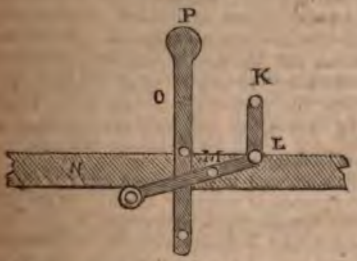


Fig. 3.



G, the boiler (in section). D, one of the steam-engine cylinders. C C, two tanks, communicating with each other by means of the pipe D. F, the condenser. N, pipe leading from the condenser to the base of the air-pump. The line E represents the main ejection-pipe of the air-pump, terminating in the refrigerator A. P is a flexible pipe to convey air and vapour from the refrigerator to the furnace.

Now, sir, in conclusion, assuming that my refrigerator, if made according to certain proportions above given, and fanned by a moderate breeze, is adequate to maintain a good condenser, I am desirous to learn the opinions of your correspondents as to whether a condensing locomotive steam-engine, constructed as in the sketch, fig. 1, combining, as I conceive, the qualities of comparative safety, greater durability, and greater power, as compared with the ordinary high-pressure locomotive-engines, would have its advantages more than counterbalanced by the inconvenience attending a single locomotive-engine, by the want of a steam blast to accelerate, and by the vapour of the *refrigerator* in retarding, combustion in the furnace, and by such other disadvantages as do not at this time appear to me.

I shall be very glad, also, to know what may be thought of my portable condensing steam-engines in extinguishing fires and in propelling vessels, &c.

S. W. NICKOLL.

Elham, near Canterbury.

P. S.—I would here suggest, that for the conveyance of merchandise, and on the common roads, a well-known application of the power of steam might be adopted, that is to say, a hollow drum furnished with buckets (after the manner of an ordinary water-wheel) might be fixed on the hind-axle of a locomotive-carriage, and enclosed in a vessel of mercury; high-pressure steam being then admitted in an upward jet into the lower buckets on one side of the wheel would, by displacing the mercury therein, cause the opposite side of the wheel where the buckets are filled with mercury to preponderate, and thus to effect the locomotion of the vehicle.—N.

MR. PERKINS' CIRCULATING STEAM-BOILER.

In 1832, Mr. Perkins took out a patent for a new steam-boiler on the circulating principle, which was more than once noticed in our Journal for that and the following year, and the advantages which it offered freely allowed; while, at the same time, its originality was as freely questioned—that is to say, Mr. Perkins was alleged to have but resuscitated, or rather re-invented (no doubt very unconsciously), a mode of construction first promulgated two or three years before in the pages of the *Mechanics' Magazine*. Mr. Perkins has now produced what he calls "a new modification" of this circulating steam-boiler; and in the first Number (just published) of the *Magazine of Popular Science*, edited at the Adelaide Gallery (which owns, we believe, Mr. Perkins for its originator, if not founder), there is a very elaborate exposition of its merits from the pen of Mr. Perkins himself. We are far from subscribing to all Mr. Perkins says in favour of his new boiler even as thus modified, for notwithstanding he assures us that his statements can be demonstrated "not only theoretically but practically," there are some of them which it would be difficult to reconcile with any received theory; and we cannot forget that this very boiler has been *tried* on the Liverpool and Manchester Railway, *but not adopted;* though Mr. Perkins, in his present essay, takes no notice whatever of that trial or of its results! But mixed up with Mr. Perkins's rather extravagant laudation of his invention we find so many valuable practical hints and so much ingenious and suggestive speculation, that we must place the whole of his paper, with but little abridgment, before our readers. Of the new periodical in which it appears, we must not omit the opportunity of saying that the projection of it does great credit to the Institution from which it emanates; and that though in this its first Number it has rather too much of a horn-book character, there is nothing either in its plan or in the talent displayed in it, to forbid our entertaining strong hopes of its proving a most useful auxiliary in the cause of practical science. We cordially wish it every success.—Ed. M. M.

Extracts from Mr. Perkins's Paper.

The following are the advantages which result from a new modification of the circulating steam patent, granted to me in 1832:—

1. Absolute removal of all the danger arising from explosion.

2. Great economy in fuel.

3. Much reduction of boiler-room, as well as of weight.

4. Not one-third of the water in the boiler now used being necessary.

5. There being no possibility of any deposit of foreign matter in the generators.

6. No furring up of the boiler, as all the deposit will of itself collect in a place provided for it, and be blown off at will.

7. The generators always being kept at the evaporating point.

8. The impossibility of burning any part of the boiler or generators by the most intense heat.

9. The boiler and generators not being in the least affected by expansion and contraction, owing to the peculiar arrangement of the tubes or generators.

10. The perfect and simple method of separating the steam from the water and foreign matter.

11. The getting up of the steam in less than half the time now required.

12. The simplicity of the construction of the boiler, and the ready method of repair.

13. The absence of all destructibility by burning,—in consequence of using anthracite coal,—although the fire be urged to its greatest intensity.

The above facts can be demonstrated not only theoretically but practically. An operating model of this boiler may be seen daily at present at the National Gallery of Practical Science.

Explanation of the first-mentioned Advantage.

The great drawback upon the important invention of steam navigation has been the disastrous effects caused by the explosion of steam-boilers. The great importance of a perfect remedy will readily be admitted. The many experiments which I have made within the last ten years, go to prove that if the steam be generated in tubular boilers, no danger can result from explosion; but there are many almost insurmountable objections to tubular boilers as hitherto constructed, particularly for steam-navigation. The boiler which is now about to be described, possesses apparently all the properties which have hitherto been sought after. To show the reason why this boiler is free from explosions, the causes (of which there are at least three) must be described.

This *first* and most common cause is from the pressure of common steam. What is meant by common or pure steam, is such as has not been suddenly elevated, or such as has not been compounded with an explosive mixture, by the improper management of the boiler.

The first kind of explosion is quite harmless, as the boiler simply rends or gives way in the weakest place, which is caused from wear, or some defective spot. The *second*, which I some years since accidentally discovered and published, (and which has since been experimentally proved to be correct, by the celebrated French philosopher, M. Arago,) arises from the water getting too low in the boiler. The fire then impinging on that part of the boiler which is above the water, causes the heat to be taken up by the steam, which rises by its superior levity to the top of the boiler, causing it sometimes to become red-hot, and so elevating the steam to a much higher temperature than its pressure would indicate. Now, when the boiler is in this state, and the safety-valve suddenly raised, the water will be relieved from the steam pressure, and rush up amongst the surcharged steam which thus receives its proper dose of water; at the same time, that part of the boiler which has been raised in temperature, giving off its heat to the water so elevated, steam is generated in an instant, of such force as no boiler can resist. This kind of explosion has of late years been very frequent and disastrous, particularly in America.

The *third*[*] and less frequent kind, although most terrific, is undoubtedly caused by an explosive mixture having been formed in the boiler. It has long been known that hydrogen has been often liberated, by the boiler being overheated by improper stoking, as well as not being properly supplied with water; but simple hydrogen cannot explode, —and where it could get its atmospheric air, which is absolutely necessary to form the explosive mixture, it has been difficult to understand. We have only, however, to look at an air-drawing feed-pump, and the source will be readily seen. It is frequently the case that the feed-pump draws air as well as water, arising from its unsoundness, &c. The more air the pump[†] draws, the less water is forced into the boiler; of course the boiler is more and more exposed to the fire, and the heated parts of the boiler become oxydised, and rapidly liberate hydrogen; and as sufficient air has been pumped into the boiler to form the mixture, it will be ignited by an overheated part of the boiler, and the tremendous effect can only be equalled by an explosion of gunpowder.

The construction of this boiler may now be described; but the practical objections to the tubular, the compound-tubular and the common boiler must also be described, so that the remedy to these practical defects may be better understood. The two greatest practical objections to the tubular boiler are its furring up and burning out. After great expense and time, I came to the conclusion that until these two practical difficulties could be removed, they would be fatal to the economical generation of steam for any other purpose than that of steam-gunnery. I have, however, at last been so fortunate as to hit upon a modification which has completely removed all objection to this method of generating steam, and which I will now attempt to describe.

This new boiler is made up of generating tubes and the common flat-bottom waggon-boiler; from this flat-bottom a series of tubes hang perpendicularly over, and in, the fire, from one to two feet in length, according to the size of the boiler, and from two to three inches in diameter. On the upper side of this flat-bottom is a continuation of these tubes, projecting the same distance into the water in the boiler. In the interior of the tubes which hang in the fire, is fixed a thin tube, two inches in diameter; when the tube is three inches, internal diameter, open at top and bottom, and ten inches in length, this tube stands upon three legs, each one inch long, and the water stands level with the top of it. These generating-tubes are hermetically sealed, so that the steam which is formed in the interior of the upper half of the tube cannot possibly escape.

The important effect of circulation is more apparent in this modification of the boiler than in any other which I have tried. The upper, or evaporating part of the hermetically-sealed tube, contains steam of a temperature of about 80° above the boiling point, when the steam is generating at atmospheric pressure; but when generating at a higher pressure, the evaporating point increases in a geometrical ratio. This part of the tube, which is surrounded with water, is incased in a very thin tube, open at top and bottom, which causes a very rapid circulation, and sweeps off the heat so effectually, as to be certain of keeping the steam in the upper part of the tube, at the evaporating point. Experience shows that, after the steam begins to form, not only the fire part of the tube, but the evaporating part of it, which is in the boiler, receives no more addition to its temperature, not even one degree —which proves the great importance of rapid circulation.

It is well known that water is a worse conductor of heat (particularly downwards) than any other matter; but, at the same time, the property which water has of carrying heat upwards, is greater than any other matter. Now, this law of the upward-carrying power of water is taken advantage of, and by filling the tube about one-third full of water, the steam which is generated is given off at the top of the internal tube, and will constantly keep the evaporating chamber filled with steam, of a temperature in proportion to the density of the steam in the boiler.

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[*] This theory has not to my knowledge been published; and until recently, I did not see how the atmospheric air could find its way into the boiler, which is so essentially necessary to form the explosive mixture.

This kind of explosion cannot take place in the new boiler, since no hydrogen is formed in it; for no part of the boiler is exposed to the fire but the bottom, which is certain to be kept at a temperature quite as low as the water in the boiler, which surrounds the generators, by the dashing down of the water outside of the circulating tubes.

Having had about twelve years' practice in generating high steam, from 1,500 pounds to the inch downwards, and having established the fact, that no dangerous result has occurred, although a great number of explosions have happened; and having at length removed all practical difficulties, I feel warranted in undertaking to guarantee to the public a system of generating steam of any required power, not only with increased economy, but with perfect safety.

[†] If the feed-pump is surrounded with water, as is inevitably the case with condensing-engines (and only such are used in this country for steam-navigation), atmospheric air cannot get into the boiler. Upon inquiry, I find that nearly all the feed-pumps used in America, are worked without having water outside the pump. This undoubtedly is one of the reasons why there has been so many more accidents *in America than in England.*

The effect of the most intense heat serves only to generate steam the faster, without raising the temperature of any part of the boiler, generating-tubes, or steam; while, without circulation, the boiler would, as is often the case, get red-hot, and generate less steam, by driving off the water from contact with it, and materially injure the boiler. So long as there is enough water in the bottom of the boiler, to be above the bottom of the circulating-tube, say two inches, no derangement of the tube can take place, as the steam and water will, although it is obliged to rise 12 inches, sweep off the heat from the evaporating-tube, which will prevent an explosion of the tube, and which would inevitably take place, when the boiler gets empty or dry, were it not that in the centre of the sealing-plug is affixed a fusible metallic plug, which is riveted into it, and will melt before the steam is sufficiently powerful to burst the tube.

For marine and locomotive purposes, it has been found that brick-work must be dispensed with, on account of its weight and bulk; of course, the fire must be made within the body of the boiler. Now it so happens, that this new modification of the tubular boiler is extremely well calculated for an internal fire-place; for we have only to extend the outward row of tubes down to the fire-bars, and we have the most convenient and economical fire-box.

Second Advantage. — Although it is not yet accurately ascertained what the saving of the fuel is, yet, from repeated experiments, I have no doubt that it will amount to one-third of the fuel now used by the best marine boilers.

Third Advantage.—The reduction of boiler room is owing to the greatly increased evaporating surface in the boiler, which allows much reduction in size, and for the same reason in weight.

Fourth Advantage. — In consequence of the interior of the boiler being filled with evaporating tubes, which displace a large portion of the water, as well as the reduced size of the boiler itself, it is not too much to say, that one-third of the water commonly used will be sufficient.

Fifth Advantage.—In consequence of there being no possible escape from the hermetically-sealed tubes, there cannot be any deposit, as the same water in the generator may be worked over and over again, *ad infinitum.*

Sixth Advantage.—The furring up of the common boiler is occasioned by the sluggish circulation of the water in the boiler, and the *extra heat at the bottom of it.* But forced circulation not only takes up the extra heat, but keeps all the foreign matter in motion, and as there is a much more rapid circulation at the fire-end of the boiler than at the other, all the matter that would otherwise deposit and become fixed, finds its way to the other end, and can be drawn off by a stop-cock at pleasure, as it will never incrust.

Seventh Advantage.—The generator cannot get above the evaporating[*] point, since the extra heat is for a certainty swept off by the rapid circulation.

Eighth Advantage.--Experience shows that wherever circulation is active, no heat can get above the evaporating point, let the heat be ever so strong.[†] This boiler is so constructed that no part of it is exposed to strong heat, where strong circulation is not at the same time going on; consequently no over-heating can by any means take place. It is a fact, that no extra heat can get into the steam, since no heat is suffered to pass into the boiler above the water, let it get ever so low.

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[*] To prove the best temperature to generate steam, I prepared an iron cup, of massive thickness, cast for the purpose; it was heated to a white heat, and, whilst it was allowed to cool gradually, several measures of water were placed in it, one at a time, each in succession, as soon as the previous one had evaporated to dryness.

The 1st measure in evaporating occupied 90 seconds.
2d 80
3d 59

The vapour, or steam, thrown off, began now to appear, and became more distinctly visible with the evaporation of succeeding measures of water.

4th measure in evaporating occupied 30 seconds.
5th 20
6th 12
7th measure showed what I had termed the evaporating point, and in a dense cloud of steam, evaporated suddenly in 6 seconds.

8th measure occupied a longer period, viz. 10 seconds.
9th measure in evaporating occupied .. 20
10th 32
And the 11th measure did not boil.

The 1st measure of water, although contained within the iron cup at a white heat, was perceptibly not in contact with the metal, but was repelled to some distance from it in a state of buoyancy, and there moved freely in every direction. So circumstanced, the water evaporated slowly; but when, by the evaporation of successive measures, and the lapse of time, the iron was cooled down to the 'evaporating point,' the water then evidently came in contact with the iron, and the augmented rate of evaporation was as 90 to 6, or as 15 to 1, the rate being increased or multiplied 15 times; or, in other words, a given quantity of water was converted into steam, 15 times quicker at a moderately low, than at an intensely high, heat.

[†] It is a curious fact, that there are now many boilers which have been in constant use for more than fifty years—the cause is, that these boilers are sufficiently large to make all the steam required, without being forced; this is done with a great sacrifice of fuel: but since it became necessary to economise fuel, the boiler has been very much reduced in size and altered in form, exposing many parts to be overheated. It is true, such boilers raise much more steam with the same fuel; and undoubtedly much more is saved in fuel than is lost in wear and tear of the boiler. This is noticed, to show the great advantage of so constructing the boiler that the heat will always be kept down.

Ninth Advantage.—The tubes of the locomotive tubular boilers now in general use, are riveted at each end; and as no provision is made for guarding against expansion and contraction, the wear and tear is enormous. The tubes, however, in this boiler are connected in the middle, and each half is allowed to contract and expand without impediment.

Tenth Advantage.—To separate the steam from the water and foreign matter, a small steam-chamber is attached to the top of the furnace-end of the boiler. A pipe somewhat larger than the steam-pipe passes from the top of the boiler to the bottom of this steam-chamber. Directly over this pipe, a dome is fixed, about three quarters the diameter of this chamber; the depth of this dome is rather more than half a sphere, and within two inches of the top of the pipe. From the bottom of the chamber there is also fixed a return-pipe, half the size of the steam-pipe, which leads down to within two inches of the bottom of the boiler. The operation is thus: When the steam rushes into the chamber, it takes with it more or less water and foreign matter (this is what is technically called priming), which strikes the concavity of the dome, and throws down the water and foreign matter to the bottom of the chamber, while the steam in a pure state passes off through the steam-pipe, and the foul water returns to the bottom of the boiler through the return-pipe.

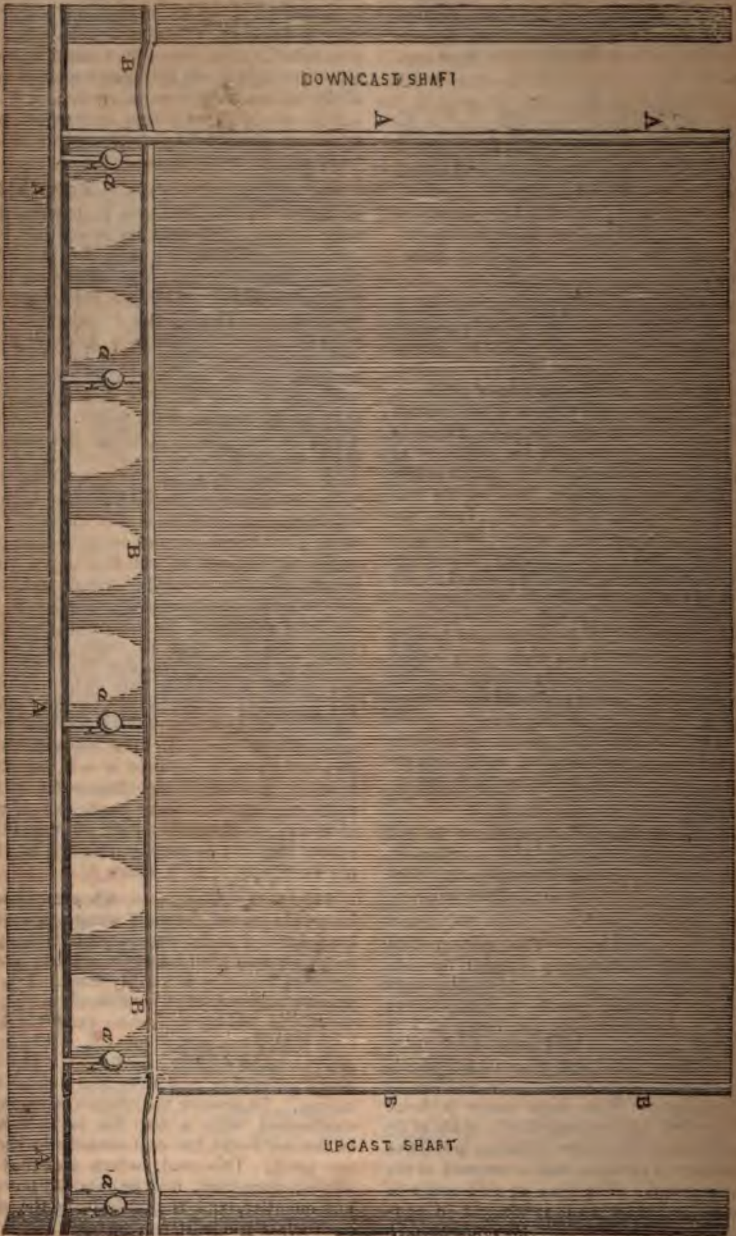
Eleventh Advantage.—The steam is got up much quicker than in any other boiler, in consequence of the great evaporating surface within it, and the diminished quantity of water in the boiler.

Twelfth Advantage. — The construction of this boiler is extremely simple: the bottom plate, after having been perforated with proper-sized holes, female coupling-screws are firmly riveted into it; the lower half of the tubes, which has been reduced one-third in size, about two inches from their ends, is formed into a male screw, to fit the female coupling-screw. This male screw is faced perfectly flat, and the shoulder is made to be screwed firmly in contact with the bottom of the boiler. The upper half is screwed in the same manner. The face of this screw is rounded, so that when it is brought in contact with the flat surface of the lower half, it may be the more certain to make a perfect joint. The upper half is not allowed to touch any part but the flat surface of the lower half of the tube. The plug-nut, which is used for hermetically sealing up the tube, is perforated in the centre with a small hole,—say one-eighth of an inch in diameter, and filled with a fusible metal, which will be driven out before the tube will rend, and which could only take place should the water be allowed to escape from the boiler.

The waggon-boiler is considered the weakest form, but this new boiler is altered somewhat in shape; the bottom is perfectly flat instead of concave; the sides are also flat; the top is semicircular. The female coupling-screws undoubtedly materially strengthen the flat bottom. The boiler is to have tie-bolts from the top, the number of which is to be determined by the strength of the steam to be generated in the boiler; they pass down vertically between the tubes, and are screwed into the flat bottom of the boiler. Tie-bolts are to be used also to hold the flat sides of the boiler from bulging out when used for high steam. None of the nuts of the tie-bolts are exposed to the fire, consequently no objections can arise from that source. This boiler may be made much stronger than any other, on account of its diminished size; setting aside the absence of any danger from the second and third cause of explosion, which has been described, the ends of this boiler, which are flat, may be made sufficiently strong by ribs. In fact, this boiler must be pronounced a perfectly safe one, since only the first kind of explosion can take place, which is absolutely harmless; the first kind has also been described. The ease with which this boiler can be repaired is not one of its least recommendations. Duplicates of the tubes may always be at hand, and if any give way, from unsoundness or any other cause, they can be readily replaced, as they are fac-similes of each other.

Thirteenth Advantage.—All persons who have been in the habit of using anthracite-coal, know that the intensity of its heat is so great, that if urged to its greatest power, the best fire-brick is readily fused. It is on this account that it is so difficult to be used for raising steam; still, some careful stokers have used it to great advantage. It is, however, done at a great sacrifice of heat,—for slow combustion and thin firing only will answer. To produce the greatest effect, rapid combustion with a deep fire is necessary. In the new boiler, the heat cannot possibly be too great. This coal, which is called in Wales, stone-coal, may be obtained there in any quantity, and is undoubtedly the most economical where it can be used, as is the case in this boiler.

SAFETY METHOD OF LIGHTING COAL-MINES. BY DAVID BOOTH, ESQ.



VERTICAL SECTION OF A COAL-MINE.

The above engraving represents a vertical section of a coal-mine, with its downcast and upcast shafts as marked on the sketch.

Within the downcast-shaft is fixed the feeding-main, which is a pipe leading from the surface to the bottom of the pit, and thence proceeding under and along the pavement to any distance, and in any direction that may be requisite: its progress is here marked by the letters A A A, &c. This pipe (having another inserted) is for the purpose of carrying atmospheric air and gas to the several burners *a a a*, &c.

B B B B B is the evacuating-main for conveying the products of the combustion, which pass along until they reach the upcast-shaft, when they ascend to the mouth of the pit (and higher if necessary), where they are dispersed in the atmosphere. This main is carried along the roof of the pit, as high as it will allow.

The supply of air and gas to the burners may easily be regulated by stop-cocks, and the lighting of the lamps may be accomplished, without exposure, by means of one or other of the various modes of producing instantaneous light called Lucifers, Eupyrions, &c., acted upon by a wire passing through an air-tight aperture. Each lamp may be separately extinguished and unscrewed from the mains, so as to be cleansed when necessary, while the others are left burning.

For working in narrow excavations, a moveable lamp may be supplied with air from the nearest part of the feeding-main, by means of a flexible tube (similar to that of a beer-engine) furnished with screws and stop-cocks, so as to be lengthened by additional pieces, or shifted to other stations at pleasure. From the required length and flexibility of this air-tube, it might be difficult to insert a gas-pipe, and probably oil only could be burnt. The distance, too, to which the lamp would, in some cases, need to be carried, might render it impracticable to convey the produce of the combustion to the evacuating-main; but, nevertheless, it is presumed that the lamp might be made perfectly safe:—in the first place, by having the chimney of sufficient length to prevent the possible egress of the flame; and, secondly, by providing that the heated vapour, before mingling with the atmosphere of the mine, should have to pass through small holes, similar to those in the rose of a watering-pot, and which *holes might be lengthened* into tubes, or *even passed through* water if found necessary. The inflammable gas of mines, if it enter the Davy-lamp, must be carried along with the current that supplies the flame, and would not readily pass into this insulated lamp, the current of which would always press outwards.

The proposer is aware that the preceding is merely a sketch of a general principle, which will require to be modified according to particular circumstances. He acknowledges, too, that, in many cases, its adoption would lead to much expense; but, as a counterpart to this, may be placed the annual saving, from premature destruction, of a great number of valuable human lives.

DAVID BOOTH.

Charlotte-street, Bloomsbury,
Feb. 8, 1836.

PREVENTION OF ACCIDENTS IN MINES.

Sir,—From reading the evidence on accidents in mines, I am induced to lay before you my views on the subject. I think that any modification of the lamp would be useless. Ventilation would undoubtedly answer could it but be perfected; the difficulty being the removal of the inflammable gas, a current of air through every part of the mine seeming to be impracticable. The plan that I should think would answer would be by electricity. The damp and dust might be prevented from coming into contact with the electrifying-machine by enclosing it in an air-tight metallic casement; letting one end of the axis extend through the casement for the purpose of affixing a handle, &c. The orifice must be made air-tight. Part of the conductor must also be extended through the casement. This orifice must have a tube of glass inserted into it for the purpose of insulation, and must likewise be made air-tight. A jar must be used; from the outside of which wires must be extended to all parts of the mine, the wires to be supported by posts, &c. By discharging the jar the carburetted hydrogen gas would be decomposed, water would be formed, and carbon deposited in the mine in a state of very fine dust. Should carbonic acid be formed, small pools of lime-water would absorb it.

The nitrogen that would be set free would be in an isolated state. Iron filings, moistened with water, would cause the nascent hydrogen contained in the water to be evolved which possesses an affinity for the nitrogen; ammonia would be formed; and the entire mine would, in consequence, be occupied by no other air or gas than atmospheric. The electrifying-machine being constantly used, say four or five times in twenty-four hours, and for about five minutes each time, no great quantity of carburetted hydrogen gas would accumulate; the explosions each time being, of course, very feeble, neither loss of life, nor other accidents, could ever occur.

I have an electrifying-machine fitted up corresponding with this plan for exhibition, and shall be glad to show it to any gentleman interested in the subject.

Yours most obediently,
Augustus Brackenbury.

55, George-street, Euston-square,
St. Pancras.

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THE HERAPATHIAN (*not* "CONTROVERSY," BUT) RETREAT.

Sir,—It appears from the communication in your last Number from Mr. Cooper (one of those numerous and handy friends of Mr. Herapath, who constantly put one in mind of the proverb, "Whoever advocates his own cause is sure to have a fool for his client"), that it is at length found necessary, in order to uphold Mr. H.'s moral as well as mathematical reputation, to invent falsehoods. "Yes, gross falsehoods!" Well, what next? I shall not suppose that Mr. Herapath himself could have had any hand in countenancing or giving currency to such falsehoods. But as matters have taken this turn, he ought to lose no time in giving an explanation in his own proper person. If he do not, then he must not be surprised, if told some fine morning to "hang a calf's-skin"—— he knows where.

The supposition of Mr. Cooper ("*aut Diabolus aut Herapathius*"), that Iver M'Iver, S. Y., H., Miso-Philo-Anti-H., F. Meredith, &c., may be one and the same person, you have yourself, Mr. Editor, flatly contradicted, and better authority on the subject there cannot be. Permit me, however, to make a few remarks. The idea that S. Y. (an engineer, and one of your oldest contributors), should be identical with me and a backer of mine, is truly farcical. Twice in the course of this controversy has S. Y. *endeavoured to show* (*see* No. 641 and 647) *that the velocities* which, I calculated for a descending plane (No. 640), were derived from *false principles*. If S. Y. wished to back me, it must be confessed that he took a very odd method of doing so. S. Y., however, in his last communication, has candidly admitted, that on this head he was in error, and in a very fair way he has explained how he was misled. Who the "strong-of-hand H." is, or Miso-Philo-Anti-H. may be (although I am free to confess, I suspect, they are identical), I know not; but I refer Mr. Cooper to your own editorial note, p. 563, No. 633, and let him couple that with your note No. 652, p. 381, and if both do not convince him of his erroneous suppositions, then, in plain English, he must suppose that you yourself, Mr. Editor, must have deliberately deviated from the path of truth. With regard to F. Meredith, of Cambridge, I know no more about him than I do of the man in the moon.

I wished, sir, for no backers. If Mr. Herapath, or any of his competent mathematical friends can fairly demonstrate (which has not yet been done) the truth of his theorems, then I shall at once acknowledge myself in error.

Want of time has hitherto prevented me from giving an analysis of the last production of Mr. Herapath (*alias* A Looker-on). He states, that where the starting velocity is 25 miles per hour, or $36\frac{2}{3}$ feet per second, and the ascent 49 feet per 707 chains—or 8 miles, 14·74 yards—which gives a rise of 1 foot in 952·28, then, according to the *dictum* of Anti-Carper (another of Mr. Herapath's *intimate* relations) the velocity per mile per hour up hill will, by Iver M'Iver's theorem, be imaginary. Mr. Herapath, however, does not give the arithmetical result of this imaginary velocity; no doubt from the consideration, that if he had done so, it might have been supposed to be "romancing." But as I am now getting a little acquainted with the Herapathian system of arithmetic, I shall now do it for him. Here, then, it is:—

$$v = \sqrt{(36\tfrac{2}{3})^2 - 64\tfrac{1}{3} \times \frac{46662}{952\cdot28}} \cdot \frac{15}{22} =$$

$$2\tfrac{9}{11}\sqrt{-113}\ !!!$$

Oh, Mr. Herapath! oh, Anti-Carper! and oh, (impartial) Looker-on! I am much afraid that Iver M'Iver will really be an old man before any of you arrive at the years of discretion.

But what is the real fact? Supposing, as they do, that the engine were not allowed to exert more power on the ascending plane than what was necessary to produce a velocity of 25 miles per hour on the level—why, then, the whole space passed over would be $S = \frac{V^2}{2gS\,\sin. i} = \frac{(36\frac{2}{3})^2 \cdot 952{\cdot}28}{64\frac{1}{3}} = 19{,}901$ feet, or 3 miles and 1,052 yards, that is, instead of the engine and train arriving at the extremity of the summit with a negative velocity of $2\frac{9}{11}\sqrt{-113}$ miles per hour, it would absolutely come to a dead halt before it reached half the distance!!!

Again, on the descending plane, Mr. Herapath forces me to apply the same power of steam as was employed on the level and ascending plane; and then he calculates from what he styles my theorem, that the velocity at the bottom (distance 8 miles and 1,474 yards,) will be 45·72 miles per hour. Well, perhaps, this might not be considered a dangerous velocity; but if it were, I must inform Mr. H. that if he would allow me to regulate the steam, I could show how the engine and train might arrive at the bottom of the descending plane, with any velocity, between the limits of 0 and 45·72 miles per hour. Mr. Herapath speaks of calculations made by Dr. Lardner on this subject, given in his evidence *against* the Great Western Railway. Now, as I happen to know Mr. H. was present during that examination, perhaps he will favour us with the principles of that calculation, as I find it is not given in the evidence of Dr. L., as published in the *Mechanics' Magazine*.

I am, Sir, yours, &c.
IVER M'IVER.

Feb. 8, 1836.

THEORY OF NUTATION.

Sir,—Although the attraction of gravity might be sufficient to produce perturbations in the planetary system, or to be the cause of motions in the mass of planets, exclusive of their annual and diurnal motions, still I consider *nutation* and *libration* to be the results of other *causes; and so far from* either of them being an accidental mode in the planetary motions, I think I can show satisfactorily that they are as necessary and absolute attributes of the planet as its orbital or axical motions.

It may be deemed presumptuous in me to impugn the efficacy of gravitation to produce the various phenomena in celestial motions; but, I shall be happy if I succeed in drawing your readers' attention to the subject, although it should terminate in the destruction of my hypothesis. To economise space in your valuable pages, I shall confine myself for the present to the development of the causes of *nutation;* and I ground them upon propositions so evident that they amount almost to axioms.

1. *Heat expands the bulk and volume of matter.*

2. *The resistance to a body in motion is proportional to the extent of surface opposed to the resisting medium.*

3. *Whatever cause* LESSENS *or* AUGMENTS *the projectile force of a planet,* ACCELERATES *or* RETARDS *its circular motion;*—and the same is true conversely of the attraction of gravity,—*whatever cause* LESSENS *or* AUGMENTS *the force of gravity,* RETARDS *or* ACCELERATES *the circular motion.*

First. That heat expands the bulk and volume of matter is a proposition familiar to every one. A rod of iron made red hot will not enter a hole it just fitted when cold. Water by heat is generated into steam, which occupies eighteen hundred times the space it did before being heated. A bladder, partially filled with air, on being exposed to the heat of a fire, will have the air within it expanded to the full dimensions of the bladder, which will burst if the heat be long applied. The same facts can be applied to our globe. What is true of its component parts, is true of it as a whole,—that is to say, heat expands the bulk and volume of our planet; and the converse of the proposition is also true. Cold* contracts the bulk and condenses

The principal source of heat to the earth is the sun. The vicissitudes of the seasons are produced by the variation of the quantity of this heat, in the earth's annual course round the sun. It follows the volume of our globe.

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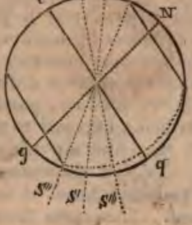
* This phrase is incorrect, strictly speaking; cold being held to be an inferior degree of heat.

from this circumstance, that opposite hemispheres of the globe are unequally heated, in fact, that one hemisphere is expanded while the other is contracted. From the autumnal to the vernal equinox, the northern hemisphere suffers contraction, being deprived of the direct influence of the sun's rays; and, from the vernal to the autumnal equinox the southern hemisphere is submitted to the same privation. The equalisation of heat on both hemispheres must occur sometime about the equinoxes, and the maximum and minimum degree of heat of each hemisphere about the time of their summer and winter solstices.

Second. The centre of gravity of the earth keeping the same position, however unequally the hemispheres of the earth may be expanded, it follows, that if the earth in its orbit be opposed by any resisting medium, an oscillatory or swinging motion will arise, the axis of the earth forming angles with the plane of its orbit, because the hemispheres are unequally expanded; and, hence, the resistance to one hemisphere will be greater than the resistance to the other, proportionally to the difference of the surfaces opposed to it.



Suppose, for example, that the greatest degree of expansion were in the southern hemisphere—to that portion of the globe the greatest resistance will be offered; consequently, the northern hemisphere will advance with a velocity greater than that of the other, in proportion as its opposing surface is less than the surface of the other; and a spectator at *s*, having the star s' vertical, will from *nutation* describe the arc $s' s'''$, while the star s' will appear to move northward in the arc $s' s''$. *The same phenomena* will ensue to an inhabitant of the southern hemisphere; and when the northern hemisphere has the greatest expansion, the opposite phenomena will take place. The angles $s' s''$ and $s' s'''$, may be taken as consistent quantities, although the times in which they are described, in decrease continually from the causes consequent upon the truth of the third proposition. To illustrate the truth of the second proposition, a piece of wood may be shaped in the form of an egg nearly, and loaded so as to be about the specific gravity of water, or just enough to sink it under the surface of the water. This piece of wood may be contrived to float so, with either end uppermost; and if a string be attached to the centre of gravity, and the wood dragged through the water, it will be found that the smaller end will advance, and the greater recede, or an angle will be formed with the surface of the water and a line which would pass vertically through the wood if at rest.

Hitherto, I have been reasoning upon the assumption of a *resisting medium*, and the truth of the proposition in detail must rest, in a great measure, upon the truth of the following:—

Third. When the projectile force and the attraction of gravity acting upon the mass of a planet are *equal*, the planet will describe a circular orbit, and persevere for ever in it, performing its revolutions in exactly the same period of time. When these forces are *unequal*, the period of the planet will be either *accelerated* or *retarded*, depending upon the excess or defect of their proportions to one another. Now we find from the results of physical investigation and from actual observation, that the periodic times of the moon and of the earth are gradually being accelerated, and the same fact may be true of the other planets of our system, which may be determined affirmatively in course of time, when a greater number of observations shall have accumulated to decide upon. Whence arises this acceleration? The original projectile impulse the planet received must be gradually lessening, either from an *increase in the original quantity of gravity or from some opposing force.* Observations cannot be made with sufficient nicety to determine whether the first supposition is the true cause of the acceleration: the effects of a resisting medium are, however, more familiar to us, and we ought first to seek in what is nearest us for solution to our problem. Your ingenious correspondent, Mr. Mackintosh, has given a beautiful and rational exposition of his electric theory of the solar system; and if we suppose the earth to be suspended, or rather floating in an electric medium, the same phenomena must ensue as when two steel balls suspended by silk from an arm moving freely on a pivot, are set in motion above the poles of a horse-shoe magnet. The balls will come to rest much sooner than they would from mere friction. The earth in its orbit, from similar electrical causes, must be receiving continual repulses, consequently its projectile force must be checked, and the force of gravity preponderating will accelerate its annual revolutions. For the earth when positively charged must discharge negatively, and *vice versa*, to promote the circulation of the fluid on its surface, and in these continual discharges depends the causes I have mentioned.

It is upon these propositions I base my theory of nutation; but, I am afraid my desire to secure brevity has risked the intelligibility of my sentences; but with your leave, sir, I shall be happy to return to any point, and give what explanation as may be required to make all I have said plain.

J. K.

London, Feb. 5, 1836.

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MECHANICS' INSTITUTIONS.

Sir,—Since the publication of the abridgment of the evidence given before the Parliamentary Committee on Arts and Manufactures in the *Mechanics' Magazine*, I have heard your conduct canvassed in no very measured terms in select coteries of the London Mechanics' Institute, for suppressing that part of the evidence of their Vice-President, Mr. Toplis, which referred to Mechanics' Institutions in general, and treated of the Southampton-buildings establishment in particular. Partially suppressing the truth, blinded prejudice, personal animosity, individual pique, disappointed ambition, and such like, are among the phrases which have been applied to you, sir, in reference to your exercise of an editorial power in omitting certain parts of a certain witness's evidence on a certain subject, which you *perhaps considered impertinent* to the object held in view on the appointment of the Commons' Committee.

But it appears to me, that so far from your conduct in this respect deserving any such hard words from the quarter in question, it rather deserved their unqualified thanks! You seem to have been actuated by a relenting sentiment, a renewed yearning of affection towards your rebellious offspring, an unwillingness to give it the *coup de grace*, as a *Mechanics'* Institute, which should have been met by it with signs of repentance and amendment. But it has not been so. On the part of the majority of grumblers, the fault has been more that of ignorance than design. They heard that certain evidence had been given by their Vice-President with reference to the Institution of which they were members; they took it for granted that it must be favourable to it. Not having easy access to the folio Parliamentary Minutes, they expected it would be republished in the *Mechanics' Magazine* amongst the other evidence. Finding these expectations disappointed, they, recollecting the Editor's position with regard to the Institute, and judging by themselves, imagined he must have some covert evil motive for its suppression.

With your permission, sir, I will set them right. There could not have been a more complete corroboration of the charges you have from time to time brought against the Institution than is contained in the evidence of their Vice-President; and the consideration who the witness is, gives double effect to the testimony. Nothing could more clearly show how miserably Dr. Birkbeck has failed, to produce a college for the education of the *mechanics* of the metropolis.

I will now transcribe those parts of Mr. Toplis's evidence which refer to the (*miscalled*) London Mechanics' Institution; there is nothing new or striking in his views of such Associations in general, as expressed in the long lecture he delivered before the members of the Parliamentary Committee.—

"What part of the Mechanics' Institution relates to the instructing of artisans in design?—There are three schools, all of which are superintended by masters that are appointed for the purpose.

"Will you state what departments are taught by those masters?—There is one class for teaching geometrical and mechanical drawing; that is, drawing to scale with the aid of mechanical instruments; another class for teaching the drawing of ornament; and a third class for the human figure; and I believe there is a fourth class for landscape, at least there was some time ago; I am not sure whether it still continues, but I believe it does.

"Do they teach perspective?—They do in the geometrical and mechanical drawing class.

"Is that sort of instruction given which would enable a person to draw patterns for fancy goods?—That is one of the branches which I include under the designation of ornamental drawing; but it is not precisely that kind of drawing which has been practised in these classes; however it would give them the facility for turning their faculties that way.

"To a certain extent you educate them for pattern-drawing, do you?—Yes, by giving them the preliminary education, certainly, though it has not been expressly directed to that one object.

"Do you give them means of studying the beautiful specimens of the antique, either in statuary or in vases?—There is another class for modelling, where they have such specimens, though not to the extent they ought to have them; but they have minor specimens, such as their own means can command.

"Have you any gallery of casts?—No, only the casts I have just now alluded to; the detached pieces; we have no gallery of entire figures.

"You have no such gallery as would amount to an exhibition of works of art, have you?—Certainly not; there is a museum of models, apparatus and specimens of minerals.

"How do you think that those branches of the art of design which are taught in the London Mechanics' Institution suffice for the necessary education which would be desirable for artisans in design?—I think there is a very fair ground-work laid, but it would require extension; for instance, in that department, which has been mentioned of pattern-drawing, it ought to be carried out into that, and into other very important branches of manufacture, one of which may be cited, namely, the porcelain and earthenware manufacture."

If only a "facility for turning their faculties that way," that is, in the way of turning their knowledge to some account—if only a "preliminary education" is given them, the A B C of drawing—where are these *mechanics* to carry on their education? It was certainly *intended by you, sir,* that the members *should receive* that full measure of instruction which should enable them to follow their several trades, less as machines than the present subdivision of labour renders the case — that each should enter upon his handicraft with a knowledge of the principles upon which it was founded, and that thus every person of thinking mind would be almost, as a matter of course, led to conceive some improvement in the branch of art on which he was employed; in fact, to predispose and to enable them to follow out the hint of the great philosopher, Boyle, so often quoted in your early Numbers, "that if every artisan would but communicate what new observations occur to him in the exercise of his trade, the advantages gained to philosophy would be incalculable." And how does the Institution help the artisan in this matter? By giving him, says Mr. Toplis, a "preliminary education" in drawing!

"What proportion do the pupils attending the schools of design bear to the pupils generally attending the Mechanics' Institution?—They are obliged to go out after attending a certain number of courses, to make room for others. I think there are five classes of drawing schools."

I really cannot see what connexion this answer has with the question. Why did the worthy Vice not give a straightforward reply? Of course, he has his reasons.

"They take what courses of instruction they please; they all follow their own inclinations as to the classes they will attend; they make application to the secretary, saying 'I wish to attend the drawing class,' or any other."

Nothing can be more palpably absurd than this. It is certainly a new system of education which allows the pupil to follow his "own inclination" in the course he shall pursue. If the instruction given were of a more advanced nature, this might be proper. I should say, by all means allow the pupil to choose the subject of his studies, but let the course be dictated by some competent instructor.

Instruction by lectures, though a very popular and fascinating method, is daily losing ground as an effective or advantageous one. Even where the information is conveyed to the pupils in regular courses (as in medical schools), from initiation to perfection, the opinion is daily gaining ground, that the system is a quackery —a complete failure. This opinion is confirmed by the fact, that those who have gained the prizes and first certificates at the London University never attended the lectures for instruction, but merely two or three times in a course, that they might get the certificate of attendance required by the Apothecaries' Company. They pursued their studies at home by the help of books. Let us hear what Mr. Toplis says of the Mechanics' Institution lectures :—

> "In the London Mechanics' Institution lectures are delivered twice a week during the whole year. From the miscellaneous pursuits of the members of these institutions, it would be inappropriate to pursue any one branch of study through a long series of consecutive lectures, like the academic courses; the courses therefore are short, and calculated by illustration to facilitate the progress of students in their private labours. For lectures of this character the larger institutions are generally enabled to compensate the services of men ranking high in science and literature."

Thus, then, by aiming at every thing nothing is done. Such a system of lectures may do very well for amusement, but it is sheer nonsense to talk of the audience gaining any salutary instruction. They are directed on the "from grave to gay, from lively to severe" system. One night the subject is pneumatics, the next dramatics — experiments in chemistry are followed by recitations and ranting from Shakspeare, "tearing a passion to tatters to split the ears of the groundlings;" then, again, they have exhibitions of the oxydrogen microscope, accompanied by lucid descriptions, in the dark, of the objects, in such technical language, that the worthy lecturer might as well have spoken altogether in Greek or Latin to the assembly as in such a polyglotical medley—succeeded by a dissertation on music, with specimens of popular airs sung by professional vocalists! Even when the transition has nothing inconsistent in it, it rarely fails to furnish matter for curious reflection; as, for example, a lecture on physiology, and the internal structure of the human body, introductory to one on external anatomy, illustrated by a man, naked to a hand-breadth, posturing after *the antique!* *This*, sir, is a *fact;* and although ladies were excluded, children were not, and the gallery of the theatre was crowded by boys from eight or nine years old to fourteen or fifteen, whom common morality would have kept out. The lecturer, in his animosity to the Royal Academy, could not, of course, think of adopting any rule they sanctioned; but there, no pupils are admitted to the "Life School" under the age of twenty-one, unless they are married. In the early days of the Institution an outcry was raised against exhibiting illustrative pictures of parts of the human form; now this foolish fastidiousness is so far conquered, that a man is hired to expose himself naked to the gaze of upwards of a thousand, for, *of course*, the theatre was crammed. I should have thought the example of the stage would have suggested, at least, silk fleshings.

The lectures, which are upon such subjects as would really be applicable to a mechanics' institution, are few and far between. They are usually in courses of three or four lectures; and a month or six weeks usually passes between each, so that it is ten chances to one but that the matter of one lecture is forgotten before another, "in the course of time," follows.

In my next extract from the Vice-President's evidence, we have, upon official authority, the very statement which you called upon the President to give, and which the Doctor has never thought proper to answer ;—his less discreet Vice has given the full extent of the claim of the Southampton Buildings Institution to the name of a "Mechanics," in almost the very words I in a former letter addressed to you :—

> "In the London Mechanics' Institution I should think they are not above one-third of the number; the average number is about 1,100; our number has been stationary at that for some years; and I should think one-third of them may be called mechanics, for there are a vast number in London who are in some way or other connected with arts of production that are not strictly mechanics. There are a great number of clerks that form part of the members; and particularly law clerks, for we are just in the centre of the law establishments, and we have a vast number of lawyers' clerks among them."

The London Mechanics' Institution—the parent of hundreds of similar associations throughout England—boasts of a little more than 300 mechanics as members, out of the thousands in the metropolis, who, were it such as was intended by its founder, would have availed themselves of its advantages.

After this, I need say no more, but subscribe myself as the correspondent who before addressed you under the signature of

A SECEDED MEMBER.

Islington, Feb. 2, 1836.

◆

NOTES AND NOTICES.

Liverpool and Manchester Railway.—The eighth half-yearly meeting of the shareholders of the Liverpool and Manchester Railway Company was held on Wednesday, the 27th of January, in the Cotton Sale-room, at the Exchange, Liverpool; Charles Lawrence, Esq., in the chair. The Report of the Directors for the last six months, which was submitted to the meeting, was highly satisfactory to the shareholders, showing a considerable increase of receipts, and in some important points a positive, and in most a comparative, reduction of expenditure. The receipts appear to have been—in the

Coaching department......	£67,897	19	2
Merchandise department..	46,375	15	8
Coal department..........	3,682	8	8
	£117,956	3	6

The increase in the merchandise department is the more gratifying, inasmuch as it has taken place in the face of a considerable reduction in the rates of freight made by the Mersey and Irwell Navigation Company, whilst the rates of carriage by the railway remain unaltered. The total expenses (including 3,409*l*. 16*s*. paid for goods destroyed by fire) amount to 71,995*l*. 13*s*. 4*d*., leaving a net profit of 45,960*l*. 10*s*. 2*d*. Out of which the Directors recommended that a dividend should be made of 5*l*. per share for the half-year; and that 6,000*l*. should be appropriated to the purchase of heavier rails, leaving a balance of 1,569*l* to be carried to the credit of the next half-year's account. The cost of locomotive-power, which has been for some time the heaviest and most formidable item in the expenditure of the Company, appears to be undergoing a gradual diminution. For the last half-year it amounted (including the cost of three new engines) to 15,681*l*. 17*s*. 9*d*., being about 800*l*. less than during the preceding half-year. This is a very satisfactory reduction, when it is recollected that there has been a large increase of business, the receipts of the last half-year having exceeded those of the half year preceding by upwards of 18,000*l*. In the maintenance of way there is an increase of about 1,500*l*.; and it does not appear probable that any considerable reduction will be made in this branch of expenditure until the line generally shall have been laid with heavier rails. The Report stated that the works connected with the tunnel under the town of Liverpool, and the new entrance in the Old Haymarket, were advancing towards completion, and would be finished by the end of the month of May. It was stated, in reply to the inquiry of a Proprietor, that the propriety of forming a new station for passengers at Manchester was under consideration, and that, if formed, it would be covered by a roof, as at Liverpool, to protect the passengers from the weather. The Report, which appeared to give general satisfaction, having been agreed to, and a dividend of 5 per cent. on the last *half-year having been declared*, the meeting broke *up.—Manchester paper.*

New Thermometrical Scale.—Dr. Castle, of Brighton, by modifying Fahrenheit's scale, has proposed an instrument which will admit of the thermometer being taken with the same precision as the barometer. The degrees are first arranged decimally, 10, 20, 30 degrees, and so on; each 10 degrees being equal to 20 degrees of Fahrenheit. The rise and fall of the quicksilver is shown by a small sliding-scale, so graduated that every degree, and even the decimal fractions, can be readily ascertained. The registering is, at the same time, accurate and easy. Thus, the freezing-point, or 32 degrees of Fahrenheit, by reduction, becomes 16 degrees; the cyphers implying that it is exactly 16 degrees; but if the quicksilver slightly exceeds 32 degrees Fahrenheit, the difference is indicated by 16 degrees 30 minutes, or 16 degrees 40 minutes, according as the excess is three or four-tenths of a degree.

Extraordinary Effects of Concussion.—The Commissioners of Police have for two or three years past been opening a magnificent thoroughfare from the Exchange to the New-road, leading to Bury, Burnley, &c. To do this it was necessary to erect an immense stone wall on the edge-banks of the river Irwell, and the average height of which was to be 50 feet. About 120 yards of this has been completed some time, and the workmen were proceeding with the remainder; the height of which unfinished wall varied from 40 feet to about 15 feet, and which was exactly opposite the works of Messrs. Collier and Co., extensive fustian-shearers and finishers, and wool-combing machine-makers. About twenty five minutes past eight this morning, then fortunately breakfast hour, or 50 men must at least have perished, this immense wall, 65 yards in length, and 7 feet thick, without warning, came tumbling down, and fell in one mass, broadside on, into the river Irwell, and the consequences are almost incredible, viz. the total destruction of the works on the opposite side of the river (which is 40 yards wide) belonging to Messrs. Collier and Co., attended with the loss of life, and of several wounded. The injury done to the buildings on the opposite side of the river may no doubt be philosophically accounted for, although not a brick nor a piece of stone that formed part of the wall could by any possibility have come in contact with them. Let it only be supposed, then, that a wall, 200 feet long and 7 feet thick, falling in one connected mass, broadside on, into the river, and some idea may be formed of the amazing concussion of the air, and the force with which such an immense mass of materials would force both it and the water against the opposite buildings, and the desolation produced may be accounted for. The roof was not only blown off, but the buildings literally blown down also, and, of course, all the machinery destroyed. *—Manchester Times.*

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price 6*d*. Also, the volume complete, in boards, price 9*s*. 6*d*.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 654. SATURDAY, FEBRUARY 20, 1836. Price 3*d*.

MARTIN'S SAFETY-LAMP.

Fig. 1.

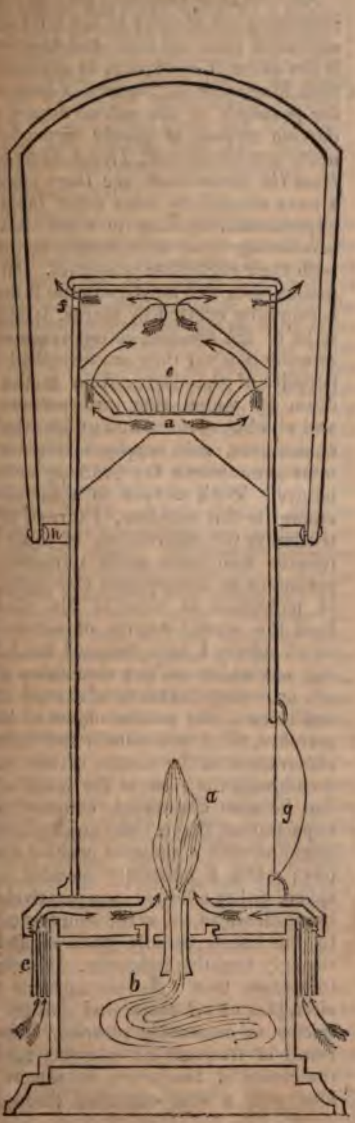
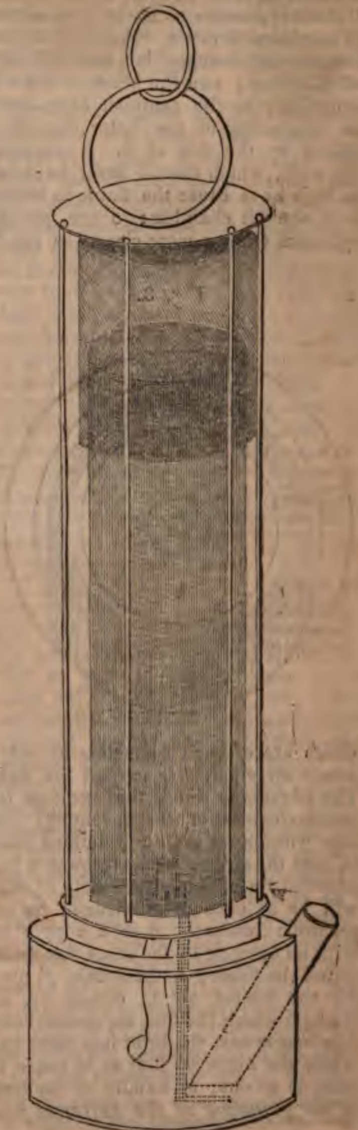


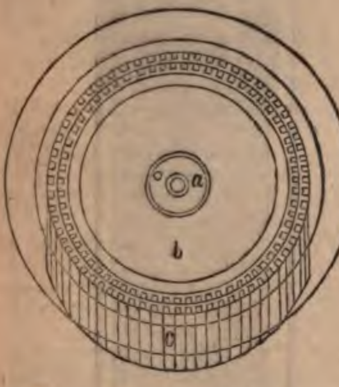
Fig. 2.



MARTIN'S SAFETY-LAMP.

Sir,—Mr. John Martin, the eminent artist, submitted to the late Committee of the House of Commons on Mines, a plan of a safety-lamp, which, though it is not noticed in their Report, and was not alluded to in the trial at the London University, seems to me to be possessed of considerable merit. Fig. 1, of the accompanying sketches, is a sectional view of this lamp; and the better to show its superiority to the common Davy-lamp, an engraving of the latter (fig. 2) is placed by the side of it. *a* represents the wick, which should never be raised so high as to cause the flame to smoke; *b* is the oil chamber; *c* are grooved cylinders (shown more clearly in fig. 3), which are of such diameters as only to admit air enough to support the flame. The advantage which these grooves (the master-feature of the invention) have over wire-gauze or thin perforated plates, is, that the air has to pass through a body of metal; a principle the safety of which will be at once acknowledged by your scientific readers. *d* is a copper top, with an opening of the same size as that round the flame; *e*, the break; *f*, places for the heated air to escape by, and through which the foul air cannot enter; *g*, a lens to cast the light into those parts where the air is so foul as to cause the lamp to go out; *h*, handle of the lamp, *on the principle* of the universal joint.

Fig. 3.



Submitting the above to the impartial consideration of your readers,

I am, Sir,
Your obedient servant,
POLLSA.

Feb. 5, 1836.

ELECTRO-VEGETATION.

Sir,—Whatever opinion may be formed respecting the identity of the fluid which emanates from the sun, and that which is the cause of electricity, as advocated in your Magazine for November last, p. 99, *the principle of the extraordinary conducting virtues of plants through their acute extremities will, I trust, be admitted from the facts which are there adduced.* I have alluded to some other facts and experiments, tending to show that this conducting virtue is intimately connected with their vegetative properties. In connexion with this most energetic influence continually exerted by plants, it appears to be of the greatest consequence to determine how far they are furnished with supplies of the electric fluid in the medium by which they are surrounded; and at what seasons, and under what circumstances, this supply appears to be most abundant in the ordinary course of nature. With a view to a satisfactory answer to this question, I turned my attention to the observations of those electricians who have made numerous experiments on atmospheric electricity, and in particular to those of Mr. Cavallo, from the second volume of whose work on electricity I have deduced the following particulars:—The electricity of the air, as distinguished from that of clouds and storms, was not the object of his researches, till it incidentally fell under his observation in the course of his experiments with the view to the latter object. But he soon discovered, contrary to his expectations, that a clear atmosphere was attended with a constant positive electricity; while a generally clouded atmosphere either afforded comparatively feeble indications, or, as the clouds gathered to blackness, usually gave signs of a strongly negative influence. His general inference, that "*the air appears to be electrified at all times, and that its electricity is constantly positive,*" was the result of frequent experiments made in the course of two years, by means of a kite with a wire extended through its string, and by an insulated electrometer of pith balls, affixed to the end of a rod, projecting from the upper part of his house at Islington. Having, however, observed a passage in Sir H. Davy's "Elements of Chemistry," in which he speaks of "clouds as being usually negative," and inclines to the conclusion, that plants are acted upon by a positive electricity in regard to the atmosphere, I took the liberty of requesting the opinion of my friend, Mr. Sturgeon, as the result of the numerous experiments which I knew he had made upon the electricity of the atmosphere, and was favoured with the following very obliging and satisfactory reply:—

"In the first place, I perfectly agree with you as to the solution of the results of Sir Humphrey Davy's experiments on corn; for the positive pot of a voltaic battery would supply the animating electric fluid to the germinating seed in precisely the same manner that nature supplies it from the atmosphere to the ground. As he does not state from what 'experiments made on the atmosphere,' he draws his conclusion that 'clouds are usually negative,' I am unable to form any opinion respecting them; but I must beg permission to state, that such a conclusion is quite at variance with the results of my experiments. It is true, I have obtained negative charges at the kite-string, but the instances are very few indeed. Those which did occur were only whilst heavy clouds passed over the kite; the indications both before and after the clouds' transit being invariably positive. And even in those temporary exhibitions of negative electricity, I am very far from concluding that the clouds themselves were negatively electric. The indications were those of the kite, which was floating much lower than the clouds; and the air in the vicinity of the kite was consequently the *only part* of the atmosphere explored during each experiment; which air probably became negative, or deprived of most of its natural electricity by the repulsive force of the accumulated electric matter in the positively charged clouds. This assertion can hardly be construed into 'begging the question" or 'straining a point,' because such phenomena are easily produced by experiment, and must frequently occur in nature.

"The results which I have obtained from experiments made at nearly all the seasons of the year, and at all times of the day, and many at night, induce me to believe that the *general* electric state of the atmosphere with its contained clouds, vapours, &c., is with *reference to the earth positive*. All electrical *phenomena are relative*, and consequently all our calculations respecting them have no other object than the ever-varying degrees of those relations; but the relations themselves appear to be constant and uniform. Therefore *I conclude generally, and my conclusions are from direct experiments, that the atmosphere taken as a whole is constantly in an electro-positive state, with reference to the earth, and that in the atmosphere itself, the upper regions are constantly electro-positive, with reference to all those situated nearer to the surface of the earth.*"

In corroboration of Mr. Sturgeon's statement, my friend, Mr. Weekes, informs me, that about twenty years since, though little more than a youth, and knowing but little of what had been done by philosophers, but being exceedingly attached to electrical experiments, he mounted a large pole on the top of a very high tree; on the top of which was fixed a large, sharp iron rod (insulated), and from it a wire communicated with a rather large but delicate electrometer, placed in an adjoining cow-shed. "I have," he observes, "turned to my manuscript notes of that period, and, with singular pleasure, I find that upwards of 90 observations made with this apparatus *during seven months, from December to July, are in perfect accordance with the experiments of our friend, Mr. Sturgeon*, as well as your own theory."

The facts, then, of the constant presence of electric fluid in the atmosphere, and of the superior conducting efficacy of the points and tubes of vegetables above that of pointed metallic rods, or any other substances in nature, are, I trust, sufficiently established; from whence the constant mutual action between them appears a necessary consequence. The tubes of plants are continually imbibing the fluid from the atmosphere, which is as constantly replenished from some other source. That that source is no other than the sun, appears peculiarly manifest from the following experiments of the Abbé Mazeas, made in the months of June, July, and October. He erected an iron rod, 370 feet in length, on an elevation of 90 feet above the horizon. Being insulated by silken cords, sheltered from the rain, at Chateau de Maintenon, when he began his experiments on the 17th of June, the electricity of the air was sensibly felt every day, from sun-rise till seven or eight in the evening, except in moist weather, when he could perceive no signs of electricity. In the driest nights of the summer he could discover no signs of electricity in the air; but it returned in the morning when the sun began to appear above the horizon, and vanished in the evening, about half an hour after sun-set. The strongest common electricity of the atmosphere during that summer (1753) was perceived in the month of July, on a very dry day, the heavens being very clear, and the sun extremely hot. The distance of ten or twelve lines was then sufficient for the approach of light particles to the conductor, in order to see them rise in a vertical direction, like the filings of iron on the approach of a magnet; whereas, in ordinary dry weather, the wire attracted the dust at no greater distance than three or four lines.* I am unable to conceive of any facts which can more directly and evidently show that electricity, in common with light and heat, derives its origin from the sun as its source and centre; it is shown to accompany him with the same constancy as light and heat, and to exist with the greatest intensity in union with his intensest beams. Some observations made by me in the course of the last summer appear admirably to accord with this conclusion. By inverting glass jars upon the soil in the day and night seasons in generally dry weather, I observe that, when neither the light and heat of the sun, nor his heat when the light was excluded, would extract any moisture from the earth, moisture was copiously given out from it during the absence of the sun, which was again absorbed on his return. As these effects appear to be the reverse of the ordinary results of light and heat upon moist bodies, I can only account for it from the opposite electrical states of the earth and atmosphere in the presence and absence of the sun. During the continual dispersing of the solar rays in the atmosphere by day it is positively electrified with respect to the earth, the moisture of which being also negative, does not combine with the fluid in the form of vapour; but, on the contrary, absorbs it while remaining in the liquid state. As night approaches, on the other hand, large quantities of moisture having transpired from the leaves, which, together with the extraction of oxygen from them in the form of gas, occupies a large portion of the solar rays in the atmosphere, the small quantity which is left in the soil combining with the rays which it has imbibed, they become positive in regard to the atmosphere, the superabundant solar or electric fluid combines with the residuum of water in sufficient quantities to transform it into vapour, in which form it rises to be almost immediately recondensed in dew, by the attraction of the fibrous and other acute extremities of the tender herbs.

What the reciprocal effects produced by the mutual action of the atmosphere and of plants upon each other actually are, is so beautifully shown in the experiment to which I have alluded in the *Atlas* for August 24, 1828, that I am tempted to transcribe it:—

> "For the double purpose of ascertaining the power of spires in modifying the electric relation of the atmosphere and the earth, and in effecting the progress of vegetation, by their electric influence, M. Astier insulated a sextuple spire of the *gleditzia triacanthus*, at the top of his house, and brought a wire from it to an insulated flower-pot, in which were planted five grains of maize; a similar sowing was made in an uninsulated pot for the purpose of comparison. The experiment continued from the 6th to the 20th of June, including two stormy days. The electrometer gave considerable signs of electricity in the flower-pot, and by using the condenser sparks were produced. The electrified grains were found to pass more rapidly than the unelectrified grains through the first periods of vegetation. When Bengal rose-trees were submitted to the same experiment, the flowers of the electrified plant appeared more rapidly and more abundantly than in the other case."

The narration is brief, and one important particular seems not to have been determined, viz. whether the electricity was *plus* or *minus*; though, from the foregoing considerations, little doubt can be entertained that the fluid issuing from the sun had rendered the atmosphere thus strongly *positive*, in a region in which his beams are so copiously dispensed. Admitting this to have been the fact, here is a clear illustration of the principle that the atmosphere, receiving a constant supply of electric fluid from its great source in the centre of the solar system, is continually imparting of its superabundance to the vegetable kingdom through its acute extremities, and thus causes or promotes its germination and growth—while a portion of it being transmitted to the earth, that approach towards an equilibrium which is essential to the general harmony of nature is maintained.

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* *Priestley's History of Electricity*, pp. 363, 364.

That the electricity of the atmosphere in the night season should occasionally be negative, and that it should ordinarily be in a less degree positive than during the presence of the sun, agreeably to the experiment above related, appears to be in perfect accordance with the very different states and operations of plants by day and night respectively. The transpiration of vapour, and the yielding of oxygen gas from the leaves, are processes peculiar to the day season, and to which the action of the solar rays is essential; whereas, during the absence of the sun they appear to be occupied by the attraction of vapours and of carbonic acid. Such, at least, are the facts which have constantly been offered to my observation in the course of the last summer, by means of numerous experiments, which I may have occasion more particularly to relate hereafter. It is true this representation does not literally coincide with the statements of Mr. Cavallo, and my friend, Mr. Sturgeon, respecting the *constant* positive electricity of the atmosphere. But their observations being principally confined to the day season, and without any particular reference to the state of vegetation, must, I conceive, be considered as mainly relating to that portion of time; while experiments relating to the variations occasioned by the presence and absence of the sun, and by the different operations of plants by day and night, and at different seasons of the year, are, I apprehend, reserved in a great degree for future investigation. In the mean time, the facts of the *general* positive electricity of the atmosphere, of the extreme conducting activity of plants in imbibing this superabundance, and transmitting a portion of it to the earth, while *the residue is efficacious in promoting their germination and growth*, is, I trust, in a great degree, established by what has been advanced. Many particulars will, however, transpire in the course of a more detailed inquiry, which may conduce to conform and illustrate these positions.

Should it be *thought* that in the above *statements I have* made too liberal a use of the experiments and observations of others, I can only plead that my general object, in a manner, obliged me to search for assistance from any authentic sources of information from whence it could be derived, and that thus they are brought to support principles which do not appear to have been in the contemplation of the excellent electricians to whom we are indebted for the facts; those I mean which are taken from printed documents, with the exception of M. Astier's, whose further communications are indeed most desirable. As to those of my two most ingenious and excellent friends, they being communicated for the express purpose of aiding me in the general inquiry, I could do no other than thus to bring forward the decisive evidence with which they have so generously furnished me in support of positions which must otherwise have remained in a great degree in the state of mere hypothesis.

I remain, Sir, yours respectfully,
T. PINE.

P. S.—In my former letter I observe the following *errata*:—

P. 101, l. 9, col. 1, for "affecting" read "effecting."

Ibid., l. 25 from bottom, for "experiments" read "experiment."

P. 102, l. 12, col. 2, after "perhaps" read "water."

P. 103, l. 7, col. 1, for "rotary" read "rotatory."

MR. GOLDSWORTHY GURNEY'S SAFETY METHOD OF LIGHTING MINES.

(From the Minutes of Evidence taken before the Select Committee of the House of Commons on Accidents in Mines.)

Has it ever occurred to you to consider whether mines might be lit under such circumstances as to do away with the necessity of the moveable lamp?—The subject has been one which I have lately considered a good deal, in consequence of being engaged again in experiments of a similar kind to those of 1822; I have recently made a series of experiments for the Trinity House, on artificial light; and the results of these experiments, and observations connected with them, induce me to believe it possible to light coal mines without taking flame at all into mines: in a few words, I will state, that I think it capable of being done by reflected light. In these experiments I found artificial light may be produced, so intense, that when placed in the focus of a parabolical reflector, it will throw a distinct shadow at the distance of eleven miles. Now, as light is capable of being concentrated, reflected and refracted in any angles, or in any direction, or in any quantities, I think it possible that such light may be reflected into mines, subdivided, and passed through the galleries, in sufficient quantities and intensity as to enable miners to work far better than by lamps of any description. The light itself, and the combustion to produce it, could be placed above the shaft, in the open air. If, however, from mechanical difficulties, such as obstructing parts in the way of its passage down the shaft, it is possible that the light might be placed in some safe part of the mine itself, where fire-damp is never found, and from thence be reflected and refracted through the various parts of the mine. I have made experiments with this view, and have found light capable of being reflected, in various directions, with simple and inexpensive reflectors; the first reflection requires a true parabolic reflector, but afterwards plain and simple surfaces will do. Possibly, the whole mine and galleries may be all lit by a single light, if not very extensive; but if seven lights of the first order be placed in the focus of seven true 12-inch parabolas, and arranged within a circle of 3 feet diameter, which they may be, I firmly believe one of the longest mines might be most effectually lighted in every gallery. No one can judge of the power and management of this light who has not seen it, or possibly conceive its practicability to the subject before us. I need not go into explanation of the manner of doing it. The Committee will remember that, as the angle of reflection is always equal to the angle of incidence, we may throw the light in whatever direction we please; by this means we may turn it round a corner at right angles, or in any angles suited to the drifts the mine happens to be cut into. The practical difficulties connected with this plan chiefly, I conceive, are those arising from obstructions in the galleries: one, for instance, is the air-doors, which are necessarily used for ventilation; there is no difficulty, however, in such case in placing a piece of plate-glass in some particular part of the door, so as to admit the passage of the light through it, or a second light may be brought in an opposite direction; again, if the galleries are so low that there is not room for the light, coal waggons or miners, to pass together, it is possible so to widen them, or enlarge them, that there would be a sufficient space for a sufficient quantity of light to pass; it may be passed through very small openings by strong concentration, and afterwards diverged as may be necessary.

Would it not be attended with great ex*pense ?—No.*

Less than the ordinary mode ?—I am not prepared to say exactly, but I think it would not be more expensive than the present mode. In case the light is not required to be very great, I think a light of less intensity might be used, with advantage, that would be less expensive than the present oil-lamps. A very simple but powerful light is about to be adopted by the Trinity Board for light-houses, which, by way of distinction, and in reference to the place where it was discovered, has been called the "Bude Light." This light produces an intensity of 140 times that of the present Argand burner; this light, therefore, may be used where the ramifications of the mine, or greater extent, does not require the first order, namely, the lime light. In some cases the light from the common Argand burner, placed in a parabolic reflector, may be sufficient, and in that case it certainly would be cheaper. I am of opinion, from the experiments and investigations made at the Trinity House, that the light from lime, and also the Bude Light, is less expensive than that of the ordinary light, taking quantity and intensity into account, which may be sub-divided to equal intensity with the first; the intensity of the one is 290 times greater than the other, and the intensity of the second 140; thus one is capable of giving the same quantity as 290 Argand burners, and the other as much as 140.

The term Bude Light has no application to the peculiar manner in which it is produced?—It is a term simply used to distinguish it.

From what is it derived?—It is produced by striking nacent carbon, evolved in the combustion of oil, resin, or similar bodies, with oxygen gas.

You have spoken of difficulties in the introduction of this new system of lighting in the mines of this country; apply your mind for a moment to the difficulties which might arise in the mines not having above two feet or three feet depth of seam?—I think such difficulties are to be overcome by inexpensive boring or widening to admit the light to pass; in such a drift a stream of light, highly concentrated, of six inches diameter, would be ample, and whether it passed by the side or the top of the gallery it matters not. A large quantity of light, by simple means, might be concentrated in such case, and passed along such an opening, and afterwards diverged in larger galleries, if such was indispensable. These are points upon which I think the Committee will find other persons more capable of giving information on than myself.

Supposing a light is required to be in a straight line for a mile, there would be no difficulty in obtaining a sufficient light at the terminus?—The light at the distance of a mile would enable you to read the smallest print. If it is reflected two or three times in that distance through a circuitous passage you would lose very little, if you use good reflectors made of speculum metal. The quantity of light lost by such reflection is very trifling.

The question related to the casting of light upon one object at the distance named?—So I have answered it; it is of little consequence whether it be straight a-head, or at the end of a curved or angular gallery.

In case that light is then to be divided into fifty different directions, so as to suit different galleries, what would be the consequence as regards the terminus?—The result would be, that the light would simply be reduced fifty times in quantity; it would be divided into fifty portions; it would then be still stronger than the strongest Argand burners; and I beg to be understood as meaning the Argand burner used on the tables of private families, not the little oil burner of the safety-lamp. I will make an observation here which may be important, namely, the stream of light may be sent through the various galleries, and when it arrives at the situation where the men are working, every man, with a little reflector or refractor, as may be determined on, may take that portion of light which may be intended for him, and no more, from the great stream, and thus limit him the quantity of light that he may abstract from the stream; which portion he may at pleasure direct wherever he pleases on the work before him; so that instead of a lamp, he would work with a little diverging reflector, or refractor, which he would carry in his pocket, perhaps of the size of half-a-crown.

Do you not think that the experiments of scientific men might be better made in the mines themselves than they could be in their own laboratory?—Certainly; if a principle is established, it rests as a matter of mechanical detail, or of mechanical situation and position, to know whether it can or cannot be applied, practically, with advantage. Sir George Cayley informs me that he used the principle of reflection to throw daylight to some men who were working a deep well. It had a beautiful effect, and answered the purpose perfectly. His reflector was nothing more than a piece of tin plate. The daylight is not sufficiently intense; we cannot focus it so as to be passed through the galleries of mines.

In your opinion, would the experiment be better conducted by placing the light above the shaft, or at the bottom of the shaft?—It would depend on the depth and size of the shaft.

Assume 200 yards in depth?—In such case above; you get at the materials and apparatus for forming the light better; the distance of 200 *yards has very little* effect in diminishing the light; reflected light does not obey the same laws as radiated light; radiated light diminishes as the squares of the distances, but reflected light does not; this is contrary to received opinions, but I am satisfied it is correct, from the observations I have lately made.

You have not supposed any difficulties in the application of this light, beyond those already stated, which the Committee understand to be the interruptions occasioned by stoppings or trap-doors in the mines, or the extreme subdivision of the reflected light?—I have: there are others, but I think of minor importance, which can only be justly appreciated in practice.

The shafts of the mines are placed at right angles, that is, they are driven along, and they begin at the further end, and then work upwards; is there any difficulty in transmitting the light at right angles?—Not any difficulty whatever; you may transmit the light in any angle you please; it may first be thrown down a shaft, and then sent into any angle, upwards or downwards, or on one side or on another.

Suppose there be a space of two or three feet left on one side, or both sides, of the carriages conveying the minerals along the galleries, the light might be transmitted independently of the space occupied by the carriages?—Certainly.

Or through a similar space above the carriages?—Yes.

And you propose, to obviate the difficulty of passing through the trap-doors, that means in the mines, by the insertion of glass in those doors; what is the smallest size you would consider sufficient for that purpose?—It would depend upon the situation in which the door was placed in the mine; if in the first gallery, where you wanted the full stream or supply of light to pass, you would require twenty inches diameter; when doors occur further on, in the division of light, perhaps three or four inches diameter would be sufficient.

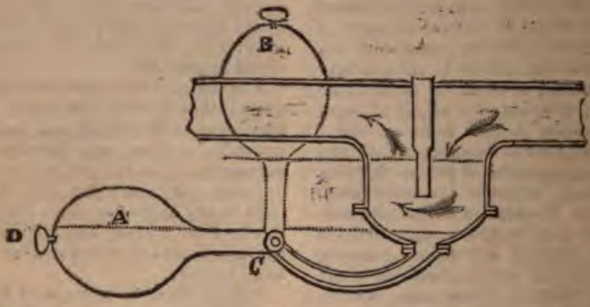
Would that be sufficient to light a gallery at the distance beyond the door many hundred yards, if twelve feet wide?—Certainly. There is another valuable natural fact that I would mention here: the stream of light, as it passes through the air, is refracted by the atmosphere, and thrown in all directions several yards, with an intensity sufficient for practical purposes. My house at Bude has a long gallery in it; I passed a stream of reflected light through that gallery; every bed-room entering into the gallery was sufficiently illuminated in every part for a person to pick up a pin. The light in the bed-rooms was refracted light, from the reflected light passing through the gallery. I conceive that unless men are working at some distance from the stream of light through a gallery a reflector would be scarcely necessary for them. Dust, floating in the atmosphere, reflects a good deal of light sideways.

Would the accumulation of dust upon glass so inserted in one of the trap-doors, be a serious impediment to the light?—Not practically, because it could be easily wiped away.

Are you aware that a boy is generally stationed to take charge of those doors?—Yes.

And of course, he might have instructions to keep the glass perfectly clean?—Certainly.

HYDRAULIC GAS-VALVE.



Sir,—Having before me, in No. 638 of your valuable Magazine, a description of hydraulic valve used in the Salop Gas-works, and knowing your willingness to publish every thing which tends to simplify as well as improve, I beg a place for the accompanying sketch (section of a similar valve on another plan), and the following explanatory remarks in your widely-circulating pages.

It will be perceived, that a valve on this plan is not supplied with water by means of a funnel (though, in other respects, it is the same as the one described by Mr. Horsman), but that there is substituted for it a vessel attached to the valve at C by means of a swivel-joint, similar to those used in gas-fittings, and equal in size to the quantity of water required by the valve to stop the flow of gas. It will be evident, that when the vessel A is filled with water and raised up, as shown by the dotted lines B, the water passing through the joint C will fill the valve and stop the passage of the gas; when by letting it down the operation will be reversed. D is a handle screwed in; by taking out which the vessel will be supplied with water.

As the inconveniences complained of by A. Y., of Nottingham, are quite avoided in this valve, I think he will not blame me for holding the same opinion of it as before.

I remain, Sir,
Your obedient servant,
JOHN THOMAS.

Redlake, near Wellington, Salop,
Jan. 19, 1836.

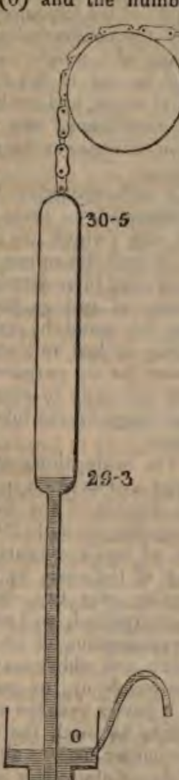
P.S.—As A. Y. states, that a valve should be as little complex as possible, why not lift his valve by hand (through a stuffing-box), as every one knows it is in vain to attempt adjusting the quantity of gas by means of a screw to supply a town? If such a thing could be effected, of what use would the regulating valve be?

ATMOSPHERIC-ENGINE AND SELF-REGISTERING BAROMETER.

The following is the description of a machine which may be called an atmospheric-engine, the motion and effect being produced through the variations in the pressure of the atmosphere. The power of the engine, as will be seen, is rather circumscribed, but still it is capable of being made to act with any assigned force through a small space. It might, perhaps, be useful in any operation requiring other machinery to be set in motion at a point of time when the barometer indicated a particular state of the atmosphere.

It is easily convertible into a self-registering barometer.

That part of the accompanying figure included between (0) and the number 30·5, represents the section of a tube, closed at top and open below. It is attached to the end of a chain, by which it is suspended, and which passes over a pulley, the other end being fastened to a fuzee and counterpoise, or a fuzee and spring-barrel. Either will be practicable; but we must conceive it to be so suspended, that it will descend through equal spaces, when it becomes charged with equal weights. The lower (open) end is to be placed in a fixed vessel, represented in the figure. This vessel contains mercury, the surface of which rises to (0), which is above the end of the tube, when the latter is at its highest point of suspension; it is so represented in the figure. The numbers indicate the length of the tube, in inches, between the points opposite to which they are placed; and, therefore, the whole space included between (0) and 30·5 will be 59·8.



The figure is drawn to represent the tube at the height at which it would be *suspended when the column of mercury it is supposed to contain* stands at 29·3, being just so many inches above (0) the surface of the mercury in which the end is immersed; the space in the tube above 29·3 being then a Torricellian vacuum. The surface of the mercury in the lower vessel is prevented from *rising* or *falling* from its place at (0) by means of a floating-cistern containing mercury, and placed in an adjoining vessel, not represented in the figure, the communication being maintained by means of a fixed syphon. The heights of the columns 29·3 and 30·5 are assumed, as limiting the space in which the greatest number of variations occur in the barometer throughout the year.

To regulate the countervailing force, and calculate the power of the engine; first, the countervailing force is to be adjusted to balance the tube in the place represented in the figure, the weight given being the small column of mercury standing 29·3 inches above the surface at (0) added to that of the tube; then supposing that the pressure of the atmosphere has increased so as to require the column to rise from 29·3 to 30·5 inches; by this rise the equilibrium just effected will be destroyed, and the tube will descend. Suppose it continues to do so until the point marked 29·3 comes on a level with the surface at (0); at this time the enlarged part of the tube will be filled to 30·5 with a cylinder of mercury, whilst the smaller part will have descended into the portion of the lower vessel made to receive it. Here, then, is given the weight, being that of the cylinder of mercury in the enlarged part of the tube, 30·5 inches long, added to the weight of the tube, and the space through which it has descended (29·3 inches), to calculate the countervailing force at this terminating point.

A twelfth of 29·3 inches will be, according to the supposition, the space through which the tube will descend after the accession of each tenth of an inch to the head of the column; and a twelfth of the cylinder standing 30·5 inches in the enlarged part of the tube, will be the increase of weight to be counterbalanced after each such accession—the difference of the columns (30·5—29·3 = 1·2) containing twelve such accessions.

Allowing the head of the column (1·2 inch) to weigh, according to the diameter of the enlarged part of the tube, 29 ounces or pounds, when the tube has descended 1 inch, it will press on any obstacle, or the chain will turn the pulley, with a force of 28 ounces or pounds; when it has descended 2 inches, it will act with a force equal to 27 ounces or pounds; and so on decreasing *one* in effect for each inch it descends. It is easy, therefore, to assign the space through which the engine will exert any force within the premised limit.

If while the pressure of the atmosphere require that the column should rise from 29·3 to 30·5 inches above the surface of the mercury at the foot of the tube, the syphon be removed, and the open end of the tube stopped for an instant, until the surface surrounding the foot can be depressed, by any means, to a distance of 1·2 inch below (0), and then the stopping taken away, the condition (that the column shall stand 30·5 inches) being thus satisfied, no further rise will take place in the column. The accession of weight gained, in this case, by the column, will be but that of a cylinder 1·2 inch long in the small end of the tube, and, consequently, the descent will be very trifling.

Supposing the head of the column to *rise* exactly at the same rate that the surface below *descends* (as is the case in the tube of the common wheel-barometer), the conditions, imposed by atmospheric pressure, will be satisfied, when half as much mercury flows into the tube as would have risen into it had the surface at the foot remained stationary, and the power of the engine will be proportionally curtailed; but the cylinder in the enlarged part of the tube, though thus shortened, will be subject to change with the variations of the column, in the same manner as that which has been described as filling the whole tube from 29·3 to 30·5.

Heretofore, to facilitate description, the cylinder of mercury in the enlarged part of the tube has been supposed to receive *equal* additions, at the times the head of the column received equal additions to its height. It is not, however, necessary that the additions to the cylinder should be equal among themselves, but only that the *sum* of the series of them, added to the sum of the contemporary accessions to the head of the column, should *together* equal 30·5 inches; or equal to the length of the longest cylinder in the enlarged part of the tube, *due* to the pressure of the atmosphere and subject to the countervailing force. The engine is also capable of acting without the aid of a floating-cistern; but certain limits must be regarded, which it was the object of the foregoing remarks to notice.

If the counterbalance be effected by means of a weight and fuzee, the fuzee may be cut to the form of almost any spiral curve, and yet be within the requisite conditions; still, however, some of these will answer the purpose better than others.

A self-registering barometer is easily constructed on these principles; for if the tube (which for this purpose should be, at least the upper part, of glass) be suspended immediately from a spring, or system of springs, the descent of which may be found by experiment, and the points marked on a scale, the tube being loaded for the purpose, a moveable index may be made to show the greatest and least range of the tube within any given time.

The scale along which the tube will range will be equal in length to the greatest descent of the tube, that is, in the foregoing example 29·3 inches. A couple of small weights suspended on the face of the scale by fine silken threads passing over two delicate pulleys, and counterpoised, will mark the highest and lowest position of an index fixed to the tube; and which may be made to raise one weight up, or push the other down, as it passes over the scale. If a floating-cistern be used, the scale of a common barometer may be also fixed at the head of the column; this is a great advantage, and serves as a test of the accuracy of the instrument.

The floating-cistern alluded to is provided to receive the mercury, or furnish it back again, without raising or depressing the surface of the mercury at the foot of the tube, when the latter rises or descends, and, of course, empties or fills. It is only a vessel set on a stem, or float, which swims in another vessel containing mercury. The stem is calculated to sink exactly as much as the surface of the fluid flowing into the cistern *rises above its bottom*. It (the stem) is cylindrical or prismatic, according to the form of the cistern, and must contain as many cubic inches as the measure of the quantity of fluid which the cistern is to hold. In length it must be equal to the *sum* of the height of the fluid above the bottom of the cistern, added to the space through which the surface of the mercury rises in which it (the stem) swims during the filling of the cistern. The stem is itself set upon a float, which will support it and the *empty* cistern just at the surface of the mercury it floats in. The principle is, in fact, the same as that described in the account of the self-registering barometer given in No. 403 of the *Mechanics' Magazine* for April, 1831. It is, however, scarcely possible to procure, by ordinary means, a glass tube 20 inches or 2 feet long of a regular form; therefore, when one is used as a cistern, a further adjustment of the stem becomes necessary, as described in that account. For the present purpose, the cistern need be only a few inches deep; and as it may be made of wood or iron, it can be had of a regular form.

It is hardly necessary to say, that in making calculations for the barometer the columns would be assumed at 28 and 31 instead of 29·3 and 30·5 inches.

One sort of counterpoise may be worth noticing. It consists of a cylindrical vessel closed at one end, and of such dimensions (adapting it to the foregoing example), that 29·3 inches in length of the inside shall contain in measure an equal number of cubic inches as 30·5 inches of the enlarged part of the tube. This vessel is to be attached to the other end of the chain by which the tube is suspended (by the closed end), the chain being merely passed over a barrel or pulley; it is then filled with mercury, and immersed, open part downward, in a vessel of the same fluid, and sunk by means of weights until the closed end comes on a level with the surface; the column in the tube standing at 29·3, as it is represented in the figure. If now the column in the tube rise to 30·5, the equilibrium being destroyed, it will descend through a space of 29·3 inches, at the same time raising the vessel at the other end of the chain, with a column of mercury in the inside of it, supported by the pressure of the atmosphere, to a height equal to the space through which it descended, when the equilibrium will be restored.

If the engine were made of dimensions suited to water, instead of mercury, a *column of 24 feet might* be depended on in all states of the atmosphere. The head, whatever its dimensions, would work with half its weight through a space of 12 feet; and if the foot of the tube were placed in an intermittent well, or in a tide, which would rise and fall a couple of feet, the engine would give a double stroke each time such rise and fall occurred; the counterpoise working as well as the weight in the tube.

W. M. G.

London, Feb. 10, 1836.

CONTINUOUS STONE RAILROAD.

Sir,—The fact that railway companies have been compelled to increase their capital in consequence of the late rise in the price of iron, has directed attention to the possibility of finding a substitute. Experiments on a considerable scale, I am informed, are now making to determine whether stone cannot be advantageously employed for this purpose, at least in the vicinity of quarries, of the suitable kinds. It is proposed to lay a continuous stone floor for each rail, of 6 or 8 inches thick and 2 feet wide, shod with wrought-iron rails by ¾ inch thick and 2¾ inches wide. To hold the rails firmly down to the stone floors, it is suggested to use bolts 9 inches apart, with heads countersunk into the rail, and nuts on the under side of the stone.

It appears, sir, that by this plan a saving of one-half, at least, of the weight of iron would be effected, and this on an article of *advancing* price is not a trifle. In many situations a floor, such as is described above, could be laid at 6d. or 7d. per running foot, and the bolts and nuts would not weigh more than the chairs, pins, keys, &c., of the present method.

Will it not prove a strong recommendation of the above plan, that the deflection will be materially lessened? Such appears to me to be the tendency of Professor Barlow's remarks quoted in your last. And will there not be some advantage also in the road being heavier than on the present plan?

It has been proposed to put a strip of felt or of thin wood between the stone and iron; I am inclined to concur in that advice; but I should like to know the opinion of others, whose experience may qualify them to give a more positive opinion than I can venture to offer.

In embanking, would it not, in many situations, facilitate the business to carry on in advance of the earth-work a wall for each rail; or, still better, a wall wide enough for both, of the whole height of the embankment, cemented for a few courses at the top. The materials could, in many situations, be had almost as cheaply as earth, and are of such kind, and may be used in such modes, as would allow the work to proceed at many points at once,—an advantage of no trifling moment in works of magnitude. Much, too, of the subsequent settling, so injurious both to the road and the carriages, would be avoided.

My principal reason for troubling you, sir, with these observations, is to request the attention of your correspondents to the project. Of the numerous mechanicians and engineers who will see them in your pages, there are doubtless some who can, and will, favour myself and the public with their opinions on the subject. If the plan is altogether impracticable for any reason whatever, it would certainly be performing a public service to prevent capital and attention being wasted upon it. If it be so capable of improvement as to have a chance of being brought into operation, it will probably much facilitate the adoption of that wonder-working invention—the railroad—to point out the errors of the foregoing suggestions, and the alterations necessary to success.

I am, Sir,
Yours with great respect,
A Promoter of Railways.

Feb. 9, 1836.

[Since receiving the above, we have been informed that a continuous stone railroad has been adopted, in several instances, in America. From the experience there acquired, it appears that when the iron bands are laid immediately on the stone, considerable wear takes place; but that this is entirely prevented by interposing a strip of wood 1¾ inch thick. The plan of fastening (in which much of the difficulty seems to lie), is to insert a plug of wood in the stone, and drive home into it a square spike of such a size that its corners should touch the circumference of the hole in the stone. The dimensions of the iron-band, proposed in the above letter, seem to be sufficient *for a velocity of* sixteen or twenty miles *per hour; but on* the New Orleans and *Nashville Railroad* (Mr. Ranney, the very intelligent chief engineer of which, is now in this country), it is intended to use a band 3 inches wide by 1 inch or ⅞ths thick, and the tracks are to be 5½ feet wide. This road is intended to bear a velocity of 60 miles per hour; and Mr. Stephenson has actually contracted to supply an engine, which will perform this with a load of 200 tons!—Ed. M.M.]

◆

IMPROVED METHOD OF BLASTING ROCKS.

(From Evidence of John Taylor, Esq., before the Select Committee of the House of Commons on Accidents in Mines.)

Have any improvements been recently made in the mode of applying gunpowder to blasting in Cornwall?—Yes; I think two or three important ones.

Have the goodness to describe the former practice and the present?—The blowing rock by gunpowder is a simple process; the hole is bored into the rock, and in such direction as to expose the weakest part to the action of the powder; this hole is charged with a certain portion of gunpowder, and is then filled by clay, or more usually with a soft kind of rock, which is rammed into it, leaving a small orifice through which the rush or fuze is afterwards introduced for setting fire to it. The most dangerous part of this process is the ramming in of this soft rock to confine the powder, which is technically called tamping; this used to be done with an iron bar; that bar striking siliceous portions of the rock, inflamed the powder, and the men were injured, perhaps killed. The first improvement was making that bar of copper, or a part of it of copper; still the needle or small rod which is introduced in the tamping, to preserve the orifice for blasting, was of iron, and that sometimes inflamed the gunpowder: some years ago we substituted copper instead of iron, and in doing so had very great difficulty with the men; it was one of the strangest things possible to see the masters and the agents taking all possible pains to preserve the men's lives, and to find the men so reckless, that though those copper needles were given to them at the same cost only as the iron ones, they would not for a long time use them. I believe we prevailed at last by depriving all the men who were injured in that way of the relief which is usually given from a fund raised in the mine; and I believe that was more effectual than any thing else that was attempted, though we tried fines and many other expedients. That copper needle is now generally used, which is the second improvement that has been introduced; but I think the last improvement is one of the best; it is the invention of a person in Cornwall, who has made what he calls safety-

, instead of the usual practice of filling
h or tube with powder and dropping it
the hole; this person has invented a
in which is introduced a thin vein of
owder, and is covered with tar or pitch;
he safety this gives is owing to a certain
h burning in a certain time. Accidents
place frequently to the man who had to
he hole; for instance, in sinking at the
m of the shaft, the workman has to fire
ole, and then to be drawn up by a single
ver it; if the fuze communicate to the
wder more rapidly than he expects, he
wn to pieces; but with the safety-fuze
ay take two feet or three feet, and so
the explosion that he may be sure to be
lace of safety before it happens. This
de so cheaply, that no difficulty has
ound in its introduction; the men are
ed with it, so that it is not worth their
to make the common fuzes, and I think
ne of the most happy thoughts that has
red.

◆

HISON'S AND TAIT'S GASOMETERS.

,—You favoured me by publishing
ır Journal of January 30th my de-
ion of Hutchison's gasometer; I
now to beg your insertion of the
ing reply to a letter, signed " W.
which appeared in your last Num-

are referred by that gentleman to
icle in the *London Journal of Arts*,
ne, 1824, describing a gasometer,
he represents to be "exactly similar
its essentials to that claimed by
en Hutchison."
ave examined Tait's gasometer, and
declare, that the two inventions
Hutchison's and Tait's) are essen-
different. They disagree in their
mportant and material features.
defects of the one are so remark-
that though abundantly tried, it
never be brought into use; while
ison's gasometer proved one of the
conomical reservoirs for gas that
t been adopted. It is therefore
ely improbable, that the latter gen-
will ever disturb that priority of
which Mr. Tait charges him with
claimed.
principle of Mr. Tait's gasometer
en known for many years; Hutchi-
a recent invention, not yet four
old. The one was found to be so
tely impracticable, that it was
considered *necessary to secure an*
ual right by the purchase of a patent; while the other has been deemed worthy of that expensive security; and so advantageous has it proved to the enterprising company that first adopted it, that the other principal gas establishments of the metropolis have adopted Hutchison's invention into their works. The improvement is also becoming generally known in the country, and gasometers on his plan are now erecting on the continent.

If, therefore, Tait's and Hutchison's gasometers are upon one and the same principle, how does it come to pass, that the first-named gentleman's plan, although universally known for thirteen years, is no where in use at the present time—considering, especially, that parties who were desirous of trying the experiment, were not prevented from doing so by any legal impediment?

I am aware that Mr. Tait did exert himself with most creditable perseverance to induce gas companies, both in town and country, to adopt his suggestion; but I know, also, that though he succeeded in having a trial made, he suffered the pain of witnessing its complete failure. Therefore, to use that gentleman's own words:—"If there be any merit in the invention," he (Mr. Tait) is undoubtedly entitled to *all* the advantage which have or may result from it.

I see by a document now before me in that gentleman's hand-writing, "that his gasometer had been tried at Leeds previous to his public announcement in June, 1824." Now if a gasometer upon his plan were ever in use in that town, its services must have been dispensed with many years since, as no apparatus of this description is now employed there. Very recently the *new* Leeds Company erected three gasometers upon the usual plan; and the *old* company, within the last four years, built a gasometer of large dimensions also upon the common method. Here are corroborative proofs, not only of Tait's gasometer being discarded, but that four years ago Stephen Hutchison's invention was *unknown*. Had the Leeds Companies been acquainted with this invention, no doubt they would have adopted it; and the old Companies could have converted *all their* old gasometers into the "double-lifting" principle, at less expense than was incurred, by the exertion of the single gasometer just alluded to.

"In the works which I erected," Mr. Tait writes, "I introduced," &c. Where are those works? Were his gasometers then and there erected? If so, are they now to be seen in actual operation, or have they been for ever abandoned? I pause for a reply.

If Mr. T. desires it, I will inform him of several places where he can see Hutchison's plan in constant use.

Mr. Tait labours under a delusion, if he is sincere in believing himself to be the originator of the telescopic gasometer. Neither can Stephen Hutchison establish a claim to priority of invention in respect to it. Let me inform both these gentlemen, that more than sixteen years ago a gasometer was erected upon this principle, invented by Mr. Hurst, of Leeds. It did not succeed, and was immediately abandoned. Also in June, 1818, a Mr. Stratton took out a patent for a gasometer constructed upon the same principle. Several were built under the directions of this gentleman by the Chartered Company, and after an enormous sacrifice of capital, they were found to be useless. To go even still further back—in the year 1802 Winsor, in conjunction with Joseph Hutchison, was pursuing a series of experiments upon the effects of coal gas at the house of a retired coach-master, of the name of M'Kenzie, in Green-street, Grosvenor-square. The retort used by these gentlemen contained upwards of thirteen bushels of coals; and as the gas used in the experiments proceeded directly from this retort, Hutchison was justly apprehensive of the occurrence of accidents from an undue pressure on the apparatus, and being a man of great mechanical knowledge, he attached a tube (resembling in appearance a syphon,) to the upper part of the retort; the other extremity being placed in a common pail, in which was water about fifteen inches deep. By this simple contrivance, all harm likely to result from a sudden pressure of gas was effectually obviated. Hitherto, Winsor and his coadjutor, Hutchison, had been conducting those experiments at their own risk and expense; but about the year 1805, a committee of seven gentlemen subscribed 100 guineas each to enable *the above* individuals to arrive at such *a degree of certainty*, with regard to *the practicability of* applying gas to *useful purposes*, as would justify them in the forming a company for the lighting of the public streets. During one of the meetings of this committee, which was held at the Star and Garter, in Pall-Mall, Joseph Hutchison, for the purpose of showing what could be done with gas, introduced a reading-lamp with a water-tube; by means of which the burner might be raised or lowered at pleasure.

This was the origin of the hydraulic-joint—one of the most useful contrivances which have yet been adopted in the manufacturing of gas. It is employed in a hundred different ways, and to as many purposes. The various gasometers I have alluded to in the course of this letter, were constructed from a previous knowledge of the above invention. To the unskilful and unscientific application of this joint is to be attributed the failure of Mr. Tait's plan;—and to its better adaptation, Stephen Hutchison owes a superiority and success of his invention.

As Mr. Tait, it would appear, seems unconscious of the defects of his gasometer, I will take leave to point out a few of them.

The hydraulic cups being attached to the inner margins of the cylinders, forming his gasometers, are necessarily placed beyond the reach of workmen, and from under the control of the attendants, in the event of an accident. This is so unwarrantable an oversight in a gentleman laying claim to the title of engineer, that I am amazed he should, after an experience of thirteen years, *still* persist in making a public display of the blunder.

Let Mr. Tait imagine the situation of a Company who were depending upon any number of his gasometers for a supply of gas during a severe, or even an ordinary frost—no ingenuity could apply any means for breaking the ice which would certainly be formed by the water in each of the cups. The Baltic or the Scheldt are not more effectually sealed against navigation during the winter months, than would his gasometers be against all practicable use under such circumstances.

Then with regard to the arrangement of the divisions. The placing of the larger cylinder over the smaller is an error which alone would render his apparatus totally useless. Mr. Tait must surely be aware, that the continual vibration which his gasometers would be subjected to (during even a trifling current of air) would cause an incessant and most inconvenient of the lights. It is probable that the superincumbent weight of the top cylinder would occasion a sudden and violent inclination of all the gasometers; the consequence of which would be their total destruction, and the loss of every particle of gas contained in them.

These are merely a few of the objections which might be urged against Mr. Tait's principle. I will refrain from unnecessarily occupying further the valuable columns of your Magazine, and take my leave of the subject, by allowing Mr. Tait, the sole and undisputed merit of his notable invention.

Clovis.

Feb. 4, 1836.

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SCRIVENER'S WROUGHT-IRON RAILWAY CHAIRS.

Sir,—In reading your interesting and valuable miscellany, I have been much gratified and amused with the different articles on railways: it seems as though the scientific and mechanical world were all intent on the subject, for it appears to be calling forth all the learning of the one and the ingenuity of the other; and it must be allowed to be a subject of such importance, that science and art cannot, at this time, be more usefully employed on any other. That there is and will be difference of opinion on the subject, is no more than is to be expected; but amidst all the plans and suggestions that are, or may be, advanced, the discriminating and skilful engineer will know what to choose and what to reject. The subject of rails and chairs has occupied some space in your Magazine, and my object in now writing to you is to call the attention of railway companies and engineers (particularly those of the continent of Europe and America), to a wrought-iron pedestal or chair, patented by Harry Scrivener, Esq., a gentleman connected with the British Iron Company. That a wrought-iron chair must be better than a cast-iron one, no one, I presume, will deny. Why else adopt the wrought-iron rail in preference to the cast-iron one? It *cannot be simply owing* to its extra *length, and, consequently*, causing fewer joints in a railway. The superiority of wrought-iron chairs to cast ones, must be, to say the least, in proportion, as wrought-iron is superior to cast-iron. What the comparative strength of cast and wrought-iron is, I cannot exactly say, as it differs according to the quality. But suppose a wrought-iron chair of 10lbs. weight to be equal in strength to a cast-iron one 20lbs., and the cost to be the same in the manufacture, the advantage to the purchaser is one-half in the conveying of chairs from the *ironworks* to the place of destination; so that if a double railway one hundred miles in length take, in cast-iron chairs of 20lbs. each, 6,775 tons, it will take, in wrought-iron chairs of 10lbs. each, but 3,387 tons 10 cwt; which is such a saving in carriage, as one would think would not be lost sight of—especially by the purchaser for the foreign market. Another advantage of the wrought-iron chair to the cast-iron one is its durability. As the oxydizing influence of the atmosphere is not so great on wrought-iron as cast-iron, the durability of the one, compared with that of the other, must be in the ratio of corrosive liability.

Now, sir, as utility and economy must always be two leading considerations in all railway undertakings, the wrought-iron chair must, in point of saving, alone have ample recommendation.

Yours truly,
A Subscriber.

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WORKING OF THE NEW PATENT LAW AMENDMENT ACT.

(From a Correspondent.)

The provisions of this precious specimen of legislation, have been again brought into discussion before the Judicial Committee of the Privy Council, and another blunder discovered in it. Baron Heurteloupe applied a few days since to have a patent confirmed under Sec. 2. No action had been brought, and verdict obtained against him; but he admitted, that an invention, similar in *principle*, was known and patented in *France* some years before the date of his patent in this country. His application was not even opposed, but the Judicial Committee expressed very great doubt, whether, as the *principle* was not published in *England* before the date of the Baron's patent, they had jurisdiction, under the Act, to confirm such a patent. The words are—"if the patentee shall discover that some other person had, unknown to such patentee, invented or used the same *before the date of such Letters Patent.*" It was admitted on all hands, that this must mean *invented* or *used* in *England.* The further hearing was kindly postponed by the Judicial Committee till the 5th March, to enable the Baron to obtain an affidavit (if he can) to prove that the French principle was published in *England,* in some manner or other, prior to the date of his patent; so that the patentee is called upon to *impeach* his own patent, *in order to get it confirmed;* or, in other words, to kill himself, that he may be again resuscitated by this new patent principle of legislation. Lord Lyndhurst distinctly said, "This Act must be amended." We hope his lordship will set about it in good earnest,—there is no person better qualified to take it in hand.

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NOTES AND NOTICES.

Electrical Theory of the Universe.—The gentleman who called at the office of the *Mechanics' Magazine,* in reference to a proposal for delivering lectures on this subject, is informed, that Mr. Mackintosh has left his address at the office, and that he will be happy to communicate with him relative to the object of his inquiry.

London Fire-Engine Establishment.—We are informed by a correspondent, that during the last week the Licensed Victuallers Fire Assurance Company have joined this establishment; so that there is now only one Insurance Company (the *County*) which has not given its adherence to the brigade. We trust this *independent* course will not be long continued.

Extensibility of Gold, Silver, and Platina.—The hundred-thousandth part of a grain of gold may be seen by the naked eye; and a cube of gold whose side is but the hundredth part of an inch, has 2,433,000,000 of visible parts. A cylinder of silver covered with gold leaf may be drawn out 350 miles long, and yet the gold will cover it. Gold leaf can be reduced to the three hundred thousandth part of an inch; and gilding to the millionth. Silver leaf can be reduced to the hundred and seventy thousandth. The specific gravities are 193 to 105. Lace-gilding is the millionth of an inch thick; gold leaf the two hundred thousandth. Platina wire may be the fifty thousandth of an inch; 500 inches of gold-wire has been drawn from a grain. Tin-foil is the one thousandth of an inch, that is, 200 gold leaves are only equal in thickness to one of tin-foil. One grain of gold will cover 7½ inches each way, or 52 square inches, or be 1,500 times thinner than writing-paper, that is, a sheet of writing-paper would be 1,500 leaves.

A 200-*Scavenger Power.*—M. Bernel, an engineer at Lyons, has invented a machine, which, worked by one horse, collects and throws into a cart, in a given time, as much mud as could be collected by 200 scavengers.

Important to Bakers.—A mechanical kneading-trough has lately been invented by a baker of the name of M. Fontaine, at Paris, for which he has obtained a patent from the French Government. The chief advantages derived from this new invention are, that from 30 to 800lbs. of dough can be kneaded in the small space of 15 minutes, with the labour of only one man, and that without the least fatigue. *It also causes the dough to be much better kneaded, consequently the bread is much better made than by the process usually adopted. The invention is the fruit of long experience.*

Railway Tunnels.—At the last meeting of the Institute of Civil Engineers, a communication was read from Mr. George Smith, engineer to the Leeds and Selby Railway, on the ventilation of tunnels on railways, whose experience has been founded on the construction of the first in this country, of half a mile in length, at the entrance from Leeds. Although, after the passage of a carriage, the tunnel appears to be filled with smoke and steam, it becomes perfectly clear within five minutes afterwards—the time, however, depending upon the state of the atmosphere and the wind. No inconvenience, likewise, is felt by passengers in their respiration—a free circulation of air always taking place through the shafts.

"A late Member" is evidently very imperfectly acquainted with the bearings of the answer *given* by Mr. Toplis respecting the London Mechanics' Institution. We by no means agree with a "Seceded Member" in all he has said on this subject; but neither his statements nor arguments are materially affected by the letter of our present correspondent.

If "A Looker-on" will furnish us with a real name and address by which we can ascertain positively that he is not Mr. Herapath, but "a different person, resident in a different country," we will publish his letter. But, with our present impressions, we must decline doing so. When we reflect that in the letter of "A Looker-on" Mr. Herapath is represented to be *the only* mathematician in existence who *could* solve a certain problem, we cannot help being of the same opinion as our esteemed and venerable friend, Iver M'Iver, that this "Looker-on" must be "*aut Herapathius, aut Diabolus.*"

We never said what "Galwigiensis" accuses us of saying, and challenge him to make good his assertion by proofs.

All that "Hard Rub" states respecting the "India-rubber case," or rather India *non*-rubber case (because in *this case* the chief merit consists in the dissolving and incorporating of the India-rubber) may be very true, and yet Messrs. Macintosh, Hancock, and Co. be most unjustly and unhandsomely treated. Can any one deny that it is wholly owing to these parties that the caoutchouc manufacture is now so fast rising into magnitude and importance? Or any liberal and impartial person dispute that they are entitled to all the advantage they can derive from the exclusive enjoyment of their patent for a limited period? The *injustice*—such as there is in the case—does not consist in "certain parties" securing to themselves a "monopoly of a certain manufacture" (for a few years), but in other parties insisting upon participating with them on equal terms in the benefit of a manufacture, which but for the former parties might never have had an existence.—*There's the rub.*

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

The Supplement to the last volume, containing title, index, &c. and portrait of Charle[illegible]ignoles, Esq., C. E., is just published, price 6*d.* Also, the volume complete, in boards, price 9*s.* 6*d.*

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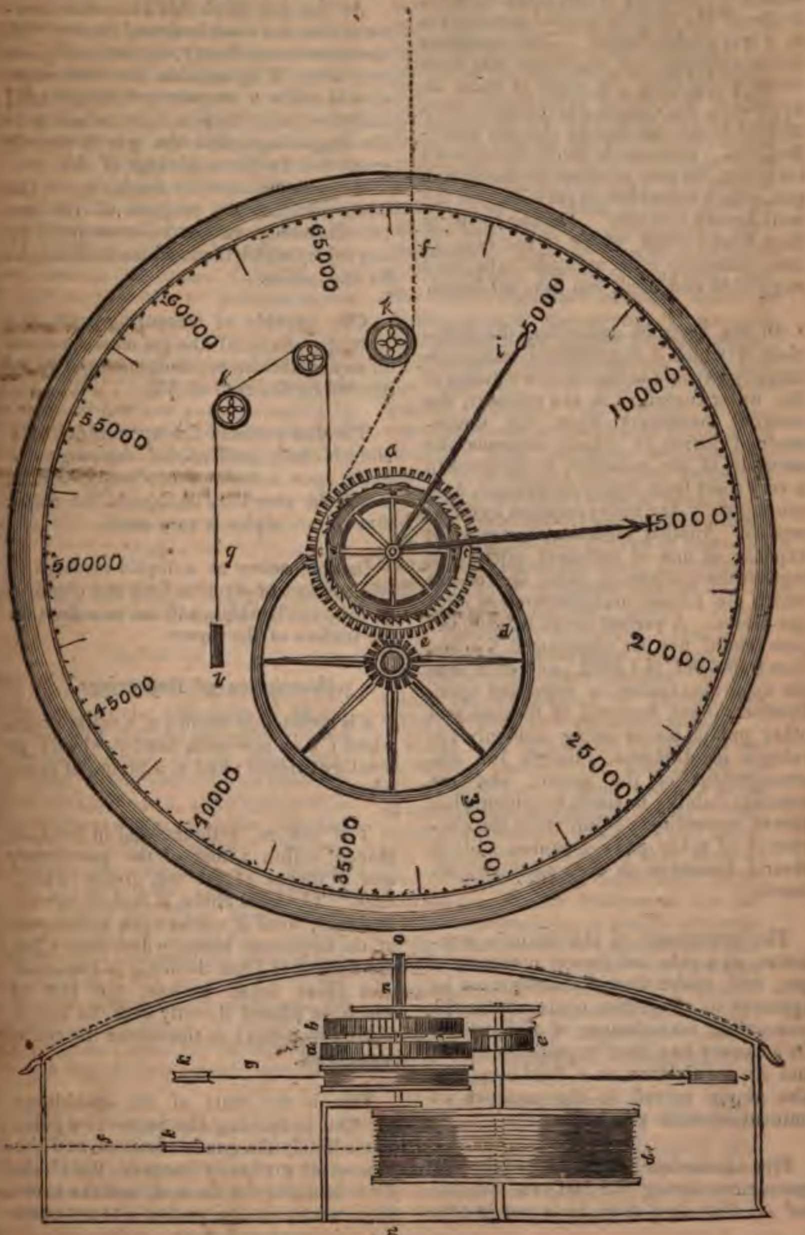
HUTCHISON'S PATENT AEROMETER.



HUTCHISON'S PATENT AEROMETER.

A safe and correct instrument for measuring the quantity of gas manufactured, is one of the most important appendages to a gas establishment. The numerous inconveniences and accidents that have taken place from the want of such an apparatus, have been exceedingly detrimental to the interests of the gas manufactories. Previous to Mr. S. Hutchison's invention, the only machine for measuring gas, which succeeded in practice, was the well known "meter." During the more than fifteen years, which it has been in use, numerous other methods have been suggested and tried, but have all failed.

In the common gas-meter, the materials of which it is composed being continually exposed to the corrosive action of the water contained in the cylinder, the internal machinery, upon the unconstrained action of which, depends the accuracy of the indicator, is rendered in a very short time totally ineffectual, and, consequently, the meter requires frequent repairs. Another objection, is the great expense of one of sufficient capacity to register the millions of cubic feet of gas which are hourly manufactured in most gas-works. A perfect meter for this purpose could not be constructed for less than from 700*l.* to 1,000*l.*; and even then the apparatus cannot be depended upon. Instances have occurred of theatres and other public places being suddenly enveloped in darkness, through the disarrangement of the meter; and the constant liability to similar accidents has proved exceedingly injurious to the characters of many gas companies, and, in several instances, to their pecuniary interests.

The importance of Hutchison's aerometer, as a safe and correct measurer of gas, will, under these circumstances, be apparent to all parties concerned in the economical manufacture of this article. Its accuracy has been repeatedly tested, and its capabilities as a fluid measurer also amply proved in the presence of eminent scientific gentlemen.

Five aerometers have been attached to gasometers during the last ten months, *and in that time they* have not in any instance failed to show the exact quantity of gas manufactured and consumed.

As the gas which this aerometer measures does not come in actual contact with the interior machinery, no inconvenience can arise, if by accident the instrument should suffer a temporary derangement; and it will also be seen, upon referring to the engravings, that the gas is merely employed as the originator of that motion which actuates the machinery in the box; therefore the progress of the gas into the mains cannot be interrupted by any injury which the machine itself might be exposed to.

One capable of measuring with the utmost precision all the gas manufactured in any establishment in London, may be erected for the sum of 40*l.*

The dial presents the appearance of a church-clock, and as the drawings are made upon a scale of one inch to a foot, it will be seen that the space the entire machine occupies is very small.

Its application as a liquid measure is effected by simply attaching the chain to an air-vessel, which will act as a float on the surface of the liquor.

Description of Engravings.

d is a cast-iron drum; *a*, a square cog-wheel; *b*, a saw-tooth ratchet-wheel; *g*, a cat-gut rigger; and *e*, a pinion or spin-wheel.

The box *m*, with the dial in front, is placed within a foot of the gasometer, and 6 inches of the top of the water-tank. The steel chain, *f*, is then carried upwards, until it reaches the under part of the horizontal beam, which rests upon the columns; from thence it is conveyed over three small pulleys, the last of which is placed directly over the centre of the gasometer; to this centre the chain is attached.

This is the state of the machinery previous to opening the inlet-valve; but immediately the gas is admitted, and the gasometer gradually ascends, the chain *f* winds round the drum *d*, and the same motion causes the pinion *e* to act upon the cog-wheel *a*, which revolves upon the spindle, to which is attached the hands *h* and *i*. The hand *h* shows that 15,000 feet of gas has been manufactured. Now, suppose that it is necessary to let 5,000 feet of this quantity into the mains—the outlet-valve is opened, the gas passes out of the gasometer — the hand *i* retrogrades to the position it occupies on the dial, and indicates that 5,000 feet of gas has been consumed: the outlet-valve is then closed, and the gas again admitted, until the gasometer is quite full; during this process both hands turn in the same direction, but still preserve the relative position shown upon the face of the dial.

The spindle *o* is enclosed in the hollow axle *n*, and to this axle is fixed the hand *i*, both of which are put into action by the revolution of the ratchet-wheel *b*. The ratchets and springs regulate the motion of the saw-tooth wheel.

C.

Feb.6, 1836.

ELECTRICAL THEORY OF THE UNIVERSE.

BY THOMAS S. MACKINTOSH.

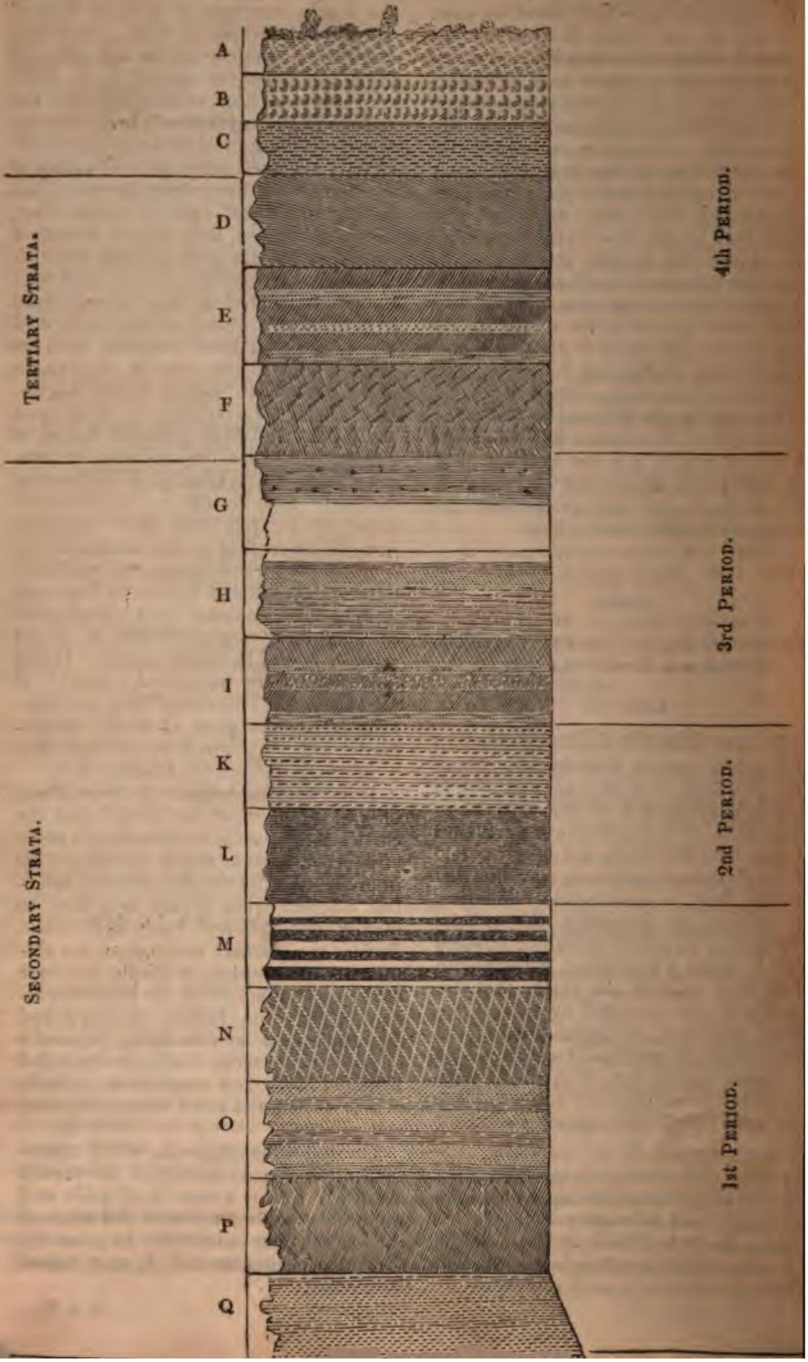
Article III.

We have stated in the concluding part of our first article (*Mechanics' Magazine*, No. 645) that we expected to find from an examination of the earth's external crust, strong presumptive evidence to show that this earth, at an early period of her planetary existence, was attended by three, four, or more moons. We cannot pretend to determine the precise number, but we think we shall be enabled to show, from a geological investigation of the solid crust of the earth, that she was at one time attended by at least five moons; and that the upper strata of the earth's crust is principally composed of the wrecks of the first four, which have been precipitated upon her surface at different and indefinitely remote periods of time.

In order that we may have a clear conception of the value of the arguments and inferences about to be adduced, it will be necessary to introduce a short sketch of the leading doctrines of geology. It cannot be *supposed that a mere inspection of* the simple structure of rocks or beds of gravel will furnish us with a sufficient knowledge whereby to fix the order of their succession, or enable us to draw conclusions of any value; although the science of geology is merely in its infancy, the body of historical facts that have been already collected relating to the state of the earth, and the various changes it has undergone in past ages, so remote that, with regard to us, they may be described as indefinite—are such as must astonish those who are wholly unacquainted with the science. Geology may be considered as furnishing a history of the earth, and the events that have occurred upon its surface prior to the creation of man, or the period when sacred history begins. If a casual observer casts his eyes upon the earth, and sees confused heaps of gravel, or beds of clay or stone, he cannot discern any symmetry or evidence of design in their formation; but the geologist, by a careful and close examination, discovers that in the mineral kingdom all the various forms and combinations are determined by laws as fixed and immutable as in the most complicated mechanism of organised life, or in the motions of the heavenly bodies. It has been beautifully remarked, that " if astronomy has discovered that the heavens declare the glory of God," as certainly are we assured by geology that " the earth showeth his handiwork."

It has been ascertained by observations in various parts of the world, that the earth's solid crust is composed of a series of parallel layers or strata, having in their internal structure very marked and essential characters, by which they may be readily distinguished from each other. Besides the peculiar features of the elementary composition, or simple structure of the rocks themselves, the greatest proportion may be further distinguished from each other by containing fragments of pre-existing rocks, shells, and petrified bones of land and amphibious animals and of fishes, and fossil remains of trees and plants.

The following diagram, which represents an imaginary section of the earth's crust, will convey a more intelligible and comprehensive impression to the mind of the reader, than can possibly be given by the most particular and minute verbal description.


A
B
C
D
E
F
G
H
I
K
L
M
N
O
P
Q
TERTIARY STRATA.
SECONDARY STRATA.
4th PERIOD.
3rd PERIOD.
2nd PERIOD.
1st PERIOD.

ORDER OF SUCCESSION OF THE DIFFERENT LAYERS OF ROCKS WHICH COMPOSE THE CRUST OF THE EARTH.

		Nature of the different kinds of Rocks and Soils.	*Instances where they are found,*
	A	Vegetable soil.	
	B	Sand, clay, gravel, with bones of animals of same species as now exist	Mouth of Thames and other rivers.
	C	Deep beds of gravel, large loose blocks, sand—all containing bones of animals belonging to species now extinct	Surface of many parts of England, and especially the eastern and south-eastern parts.
Tertiary Strata.	D	Sand, clay, pebbles, beds of hard white sandstone—many sea shells, bones of extinct species of animals	Hampstead Heath, Bagshot Heath, coast of Suffolk and Norfolk—stone of which Windsor Castle is built.
	E	Alternations of limestones, containing fresh-water shells, clays of different qualities, and limestones containing marine shells.	Isle of Wight.
	F	Thick beds of clay, with many sea shells; beds of limestone—remains of extinct species of plants and fruits, land and amphibious animals	Many places round London, great part of Essex, and north-east of Kent, Isle of Sheppey. Woolwich, Cliffs at Harwich, Isle of Wight.
Secondary Strata.	G	Chalk with flints	Dover Cliffs, Brighton, Hertfordshire.
		Chalk without flints	Flamborough Head in Yorkshire.
	H	*a.* Chalk marl	Many parts of south coast, Kentish rag.
		b. Green sand	Many parts of Kent and Sussex.
		c. Thick beds of clay	The Weald of Kent, Surrey, and Sussex.
		d. Yellow sand, with beds of iron ore	Neighbourhood of Hastings and Isle of Purbeck.
		e. Argillaceous sandstone	Flat pavement of London, very often.
	I	*a.* Limestones of different qualities	Portland building stone.
		b. Beds of clay	Kimmeridge, on coast of Dorsetshire.
		c. Limestones with corals	Neighbourhood of Oxford.
		d. Beds of clay	Extensively in Lincolnshire fen clay.
		e. Thick beds of Limestone	Bath building stone.
		f. Thin beds of limestone and slaty clay	Whitby, Gloucester, Lyme Regis.
	K	Red marly sandstone, often containing beds of alabaster or plaster stone, and beds of rock salt	Great part of East Yorkshire, Nottinghamshire' Stafford, Warwick, Worcester, Cheshire, and neighbourhood of Carlisle.
	L	Limestone containing much magnesia	Sunderland, Ferrybridge in Yorkshire, Mansfield, Notts.
	M	COAL MEASURES, containing various seams of coal—beds of ironstone, clay, sandstone, and freestones of various qualities	Newcastle, many parts of Yorkshire, Lancashire, Staffordshire, Somersetshire, vale in which Edinburgh and Glasgow are situated, South Wales.
	N	Coarse sandstone aad slaty clay	Millstones of Newcastle and Derbyshire.
	O	Thick beds of limestone, and slaty clay and sandstone, in many alternations	Deposits of the lead ore of Derbyshire, Yorkshire, Northumberland, Cumberland, High Peak of Derbyshire, mountains in Yorkshire, Mendip Hills, Somerset.
	P	Dark red sandstone, with many beds of pebbles	Great part of Herefordshire, and south-east part of South Wales, Banks of the Wye, south of Scotland.
	Q	Thick beds of slate and sandstone, with sometimes impressions of shells, with thick beds of limestone	Cumberland and Westmorland Mountains, great part of Wales, north of Devon, South Devon, and Cornwall, great part of south of Scotland.
Primary Strata.	R	Slates and many hard rocks lying in alternating beds, in which no trace of animal remains has been found, of great thickness, and the lowest that have been reached	Chief part of the Highlands of Scotland.

Here we perceive that the whole series of strata of which the earth's crust is composed is divided by geologists into three great classes or divisions, by them denominated the primary, secondary, and tertiary strata. This section is merely intended to represent the order of superposition as established by geological observation. There is no instance of *all the strata* having been found together in one place. In some places the primary rocks are found at the surface, the secondary and tertiary being altogether wanting. In very many instances, the secondary rocks are found immediately under the vegetable soil, the tertiary alone being wanting; and in every instance that has been observed hitherto by geologists, the series has been found to be incomplete, the upper members of the section represented in the diagram being often found at the surface, whilst many of the lower strata are altogether wanting. But wherever the secondary strata are found at the surface, the tertiary are never found under them; nor have the secondary rocks ever been seen lying under the primary.

The primary strata are the lowest of the three great divisions into which the stratified rocks have been classed by geologists. They consist principally of hard, slaty rocks, having a crystalline texture, by which they are distinguished; but more particularly by their not having been found to contain any fragments of pre-existing rocks, or fossil remains of animals or plants. On this account some geologists, conceiving them to have been formed prior to the existence of animal life, and that they constitute the original crust of the earth from whence all the superior strata have been derived, have denominated them the primitive rocks; while others think that there is not sufficient evidence to support this assumption, and maintain that, although we have not hitherto discovered any organic remains in these rocks, they may, nevertheless, be found at some future time, and therefore these latter have denominated them the primary strata, considering them merely as the first or oldest of the stratified rocks that have as yet come under our observation. The great distinguishing characteristic of the primary rocks consist in this —*they contain no fragments of pre-existing rocks, nor fossil remains of organised bodies.*

The secondary strata comprehend a great variety of rocks, extending from the uppermost member of the primary to the lowest of the tertiary strata. The different members of this division are distinguished by very marked characters, and are classed in the following order:—the chalk group—the oolite group—the red marl group—the coal group—the mountain limestone group—the old red sandstone group—the grauwacke group. The united thickness of all the different members of this division has been estimated at not less than 11 or 12,000 feet. In the lowest members of the secondary rocks the remains of organised bodies first begin to appear. In the grauwacke group shells and pebbles are found; the old red sandstone contains some shells and a few plants; the mountain limestone contains a great variety of organic remains; the coal group contains a vast quantity of fossil plants; the red marl group is interstratified with limestone, in which have been found the remains of gigantic amphibious animals resembling crocodiles, some of which were not less than 40 feet in length; the oolite group contains a great abundance of organic remains, almost exclusively marine; and the chalk group, the uppermost of the secondary strata, also abounds in organic remains of the same classes as those found in the oolite group. The secondary strata are distinguished from the tertiary by this circumstance—all the organic remains found in them belong to species now wholly extinct.

The tertiary strata have a totally different character from the chalk, and all below it; it is, therefore, considered that a remarkable change had taken place in the climate and general constitution of the earth prior to the deposition of the tertiary beds. The tertiary, like the secondary strata, consist of a great variety of layers, which have been classed in several groups, having distinct characters, by which they may be readily distinguished from each other. They contain vast quantities of organic remains, exclusively belonging to fresh-water and terrestrial animals and plants. The beds are found in detached, insulated spots of comparatively limited extent; unlike the secondary strata, which are found to stretch continuously throughout a great extent of country. In the tertiary strata are first found remains of animals and plants identical with living species, by which circumstance they are distinguished from the secondary strata.

An examination of the phenomena exhibited by the internal structure of this series of superimposed rocks has established this principle—that all the strata must have been deposited on a level foundation — that is, on pre-existing ground that was either horizontal or nearly so, at the bottom of a fluid holding their materials either in suspension or in solution, or partly both. Now, as we know of no fluid in which this could have taken place except water, geologists have come to the conclusion that the chief part of all the strata, however elevated they may now be above the level of the sea, were gradually deposited at the bottom of the ocean, and the remainder of them at the bottom of inland seas or lakes. But if this be so, what mighty revolutions must have taken place to cause rocks formed in the depths of the ocean to occupy the summits of the highest mountain! By what known agency can so extraordinary a change of position have been effected! That the fact of elevation is indisputable, is proved by the shells imbedded in stratified rocks at the greatest elevations; and geologists who have endeavoured to discover by what cause this change in the relative position of the rock and the sea has been brought about, by an attentive observation of the phenomena of earthquakes and volcanoes, and the resemblance between the products of the latter and certain parts of the earth's structure which we have yet to notice, have arrived at a very probable solution of the problem.

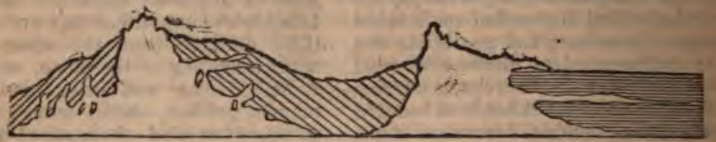
Although the strata were originally deposited in a horizontal position, and are often found so in the greater proportion of cases, *especially as regards the inferior members of the series,* represented in diagram No. 1, they are not uniformly so, but are inclined more or less, and they have been seen not only at every angle of inclination, but very often in a vertical position. Sometimes they are not only disturbed from their horizontality, but are bent and contorted in the most extraordinary way, as if they had been acted upon by some powerful force while they were yet in a soft, flexible state.

In attempting to explain the disturbed and confused state in which the strata are found, geologists have referred to the unstratified rocks and the probable manner of their formation; and it must be conceded, that in many cases their explanations are very satisfactory. It is found, that besides the primary, secondary, and tertiary stratas, which comprehend the whole of the stratified rocks, there is a fourth description of a character wholly distinct from these, that have never been found disposed in beds or layers, and are therefore called the unstratified rocks. This class must be particularly noticed, as they occupy a very prominent place in geological inquiry, and appear to have been connected with many of the great changes that have taken place in the general economy of the earth. Such *unstratified rocks,* although of limited extent in proportion to the *stratified rocks,* constitute a considerable portion of the crust of the earth, and in all parts of it they generally rise above the surface in huge unshapen masses, surrounded by the stratified rocks; and sometimes they occupy districts of great extent where none of the latter rocks can be seen. In mineral composition they are essentially different from the other class; never consisting of limestone, or sandstone, or clay, and never containing rounded pebbles, shells, or the remains of any other kind of organised matter. Their elementary constituent parts are simple mineral substances, which, although sometimes found in the stratified rocks, are always in the rocks we now speak of, in different combinations: they are always in that particular state called crystalline; and when the parts are large enough to be distinguished they are seen to interlace each other, and by this arrangement they form a very hard tough stone, very difficult to break into regular squared forms or to work with the chisel, and they are capable of receiving very often a high polish. The substances most familiar to us in common life which belong to this class of rocks, are granite, whinstone, and basalt. We shall now proceed to show in what manner these two classes of rocks are associated together. It is quite evident that the mode of formation of the two must have been totally different. While the strata, by their parallel arrangement, the pebbles of pre-existing rocks, and remains of living bodies which they contain, demonstrate that they must have been formed under water, by deposition *from* the surface downwards, the whole characters of the unstratified rocks equally prove that they must have come *to* the surface from the interior of the earth, *after* the deposition of the strata; that is, that they have been ejected among the strata from below in a melted condition, either fluid or in a soft yielding state. Geologists have come to this conclusion, from a careful examination and comparison of the unstratified rocks with the products of existing volcanoes, or those burning mountains that have thrown out streams of melted stone or lava, both in past ages, as recorded in history, and in our own time. By this comparison they have discovered a great similarity, often an identity, of composition between the unstratified rocks and lava, and the closest analogy in the phenomena exhibited by the masses of both kinds, and in their relations to the stratified rocks with which they come in contact.

In every case the unstratified rocks lie under the stratified. This order has never been reversed, except in cases which have been afterwards discovered to be deceptive appearances, and where they have been protruded between strata, as will be afterwards mentioned. But it may be said that this fact of inferiority of position is no proof of ejection from below, far less of posteriority of formation, for they might have been the foundation on which the strata are deposited; their eruption from the interior, and that that eruption took place after the strata were formed, are proved by other evidence, as we shall presently show.

A section of the crust of the earth, where the stratified and unstratified rocks have been found associated together, has often exhibited the appearance represented by the diagram, No. 2:—

No. 2.



A and B are mountains of granite or of whinstone, with strata of limestone lying upon it. From A, branches or shoots connected with the principal mass are seen to penetrate into the superincumbent strata; and in the mountain B the granite overlies the limestone for a considerable way near the top, as if it had flowed over at that place, and lower down it has forced its way between two strata, ending like a wedge. Now, as the penetrating substance must necessarily be of subsequent formation to the body that it penetrates, it is evident that the granite must have been formed after the limestone, although the latter rests upon it. But if any doubt remained, it would be removed by the additional fact, that the granite veins in the mountain A contain angular fragments of limestone, identical with the strata above, and the fractured ends are seen to fit the places of the continuous stratum from which they have been broken off.

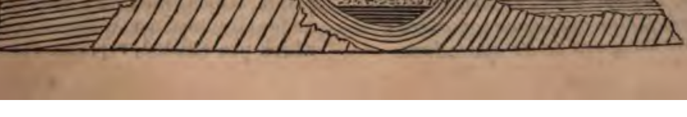
The posteriority of the formation of the unstratified rocks to the strata is thus made evident from their relative positions; their forcible ejection from below is equally proved by the penetration of their veins or shoots into the superincumbent strata in an upward direction, often with the most slender ramifications to a great distance, and by the portions broken from the strata and enveloped in the substance of the vein. That they were ejected in a soft melted state, produced by the action of heat, is shown by the close resemblance in mineral composition of the unstratified rocks to the products of existing volcanoes, and by remarkable changes often observed to have taken place in the strata where they come in contact with granite and whinstone. Soft chalk is converted into a hard crystalline limestone like statuary marble; clay and sandstone are changed into a substance as hard and compact as flint, and coal is turned into *coke;* all of them changes which are analogous to what takes place when the substances are subjected to a strong artificial heat under great pressure. In the case of coal it is very remarkable; for when a bed of that substance, and a stratum of clay lying next it, come in contact with whinstone, the tar of the coal is often driven into the clay, and the coal loses all property of giving flame, although, at a distance from the whinstone, it is of a rich caking quality.

We have shown that we are enabled to fix a chronological order of succession of the strata with a considerable degree of precision, and although we have not the same accurate means of determining the relative ages of the unstratified rocks, there are yet very decisive proofs that certain classes of them are older than others—that different members of the same class have been ejected at distinct periods, and that the same substances have been thrown up at different times far distant from each other. Granite, in veins, has never been seen to penetrate beyond the lower strata; but whinstone and the lavas of existing volcanoes protrude in masses, and send out veins through all the strata: veins of one sort of granite traverse masses of another kind, and whinstone and basalt veins are not only found crossing masses and other veins of similar rocks, but even of granite. Upon the principle, therefore, before stated, that the penetrating substance must necessarily have been formed subsequently to the body penetrated, the above phenomena demonstrate successive formations or eruptions of the unstratified rocks.

As the highly elevated, broken, and contorted positions of the strata are only explicable on the supposition of a powerful force acting upon them from below, and as they are seen so elevated and contorted in the neighbourhood of the unstratified rocks, it is a very legitimate inference that the mountain chains and other inequalities on the earth's surface have been occasioned by the horizontally deposited strata having been heaved up by the eruption of these rocks, although they may not always appear, but be only occasionally protruded to the surface, through the rents produced by the eruptive force. The phenomena of earthquakes are connected with the same internal action, and these have often been accompanied by permanent elevations of entire portions of a country. This theory of the elevation of mountains by a force acting from the interior of the earth is not a mere inference from appearances presented by rocks, but is supported by numerous events which have occurred repeatedly within the period of history down to our own time.

It must not be supposed that these internal movements only took place after the whole series of strata, represented in diagram No. 1, had been deposited. There must have been long intervals between the termination of the deposition of one member of the series and the commencement of that of the stratum immediately above it; and internal movements accompanied with disturbance of the already deposited strata, after they had come to consolidate into stone, appear to have taken place during the whole period that the strata, from the lowest to the uppermost in the series, were deposited. The clearest evidence of this is afforded by certain appearances exhibited by the strata in all parts of the globe that have yet been examined. The diagram, No. 3, represents a case of very common occurrence, and will explain our meaning: it must be borne in mind that it is an acknowledged principle in geology that all stratified rocks, in whatever position they are now found, must have been originally deposited horizontally.

No. 3.



There are here five different series of strata, *abcde*. Now, it is evident, that the series *a* must have been first disturbed; that, after its change of position, the series *b* and *c* were deposited, covering *the ends* of the strata of the series *a*. But *c* appears to have been acted upon by two forces at distant points, when thrown out of its horizontal position, for the strata dip in opposite directions, forming a basin-shaped cavity, in which the series *d* was deposited. In like manner, after the disturbance of *c*, the series *e* was deposited, covering the ends of *c*; but the internal force which raised the beds *e* from the depths of the sea to the summit of the mountain where they are now seen, appears to have acted in such a direction as to have carried up the whole mass without disturbing the original horizontality of the structure. It is obvious that all the interior strata must have partaken of this last disturbance. There are, besides, numerous proofs that there have been not only frequent elevations of the strata, but also depressions; that the same strata which had been at one time raised above the surface of the sea had again sunk down, preserving an inclined position; that they had formed the ground upon which new sediment was deposited, and had again been raised up, carrying along with them the more recently formed strata.

These are the conclusions to which geologists have arrived concerning the cause of the elevated, contorted, and seemingly confused state in which the stratified rocks are found. But it must be recollected, that this is a case selected for the purpose of illustration, and that in a vast majority of cases no such satisfactory evidence can be found. In some instances that have come under observation, this has been found sufficient to account for the seemingly confused state of the strata; it has therefore been inferred, that in all cases the same cause has produced the elevations and contortions. We cannot, for a moment, hesitate to admit the legitimacy of this inference; but as this explication cannot be made to account for *all*, nor even a majority of the appearances, especially when the oblate figure of the earth is taken into the account, we are induced to think that some other and more adequate cause must be *found, as that which is here given appears wholly unequal when compared with the effects assigned to its operations.*

Although the stratified rocks have been, by the common consent of geologists, divided into the three great classes of primary, secondary, and tertiary strata, it appears from recent observations that a much more scientific arrangement might be adopted. We beg to solicit the most careful attention to this scientific division, as affording strong presumptive evidence of the extreme probability of the truth of our theory. It is evident that the deposition of a satellite upon the earth's surface must have produced a deluge, as the matter of which it was composed would be naturally deposited in the depths of the ocean, being the lowest level; thereby forming new islands and continents, and causing the sea to overflow, to a considerable extent, the islands and continents of the pre-existing period. The observed appearances correspond very minutely with this supposition; and, as there are four distinct periods, we are disposed to infer that the earth was, at an early period, attended by at least five satellites. This scientific division of the strata is founded upon the following considerations:—It has been observed that the time which elapsed from the commencement of the deposition of the older secondary strata, to that of the most recent of the tertiary beds, appears to be divisible into four great botanico-geological periods, of unequal duration, during each of which vegetation exhibited a common character. Each of these periods, therefore, is characterised by peculiar classes of plants; or, in the language of botanists, may be said to have a FLORA of its own; and each period embraces a certain number of the series of stratified rocks which compose the crust of the globe. During the continuance of each of those periods, vegetation seems to have undergone only gradual and limited changes—to have been subject to no changes which had an influence upon the essential character of the vegetation, taken as a whole; but, on the contrary, there is between one period and another a marked division, a sudden change, in the most important characters of the vegetation. There exists no species common to two successive periods; all is different; and a new *ensemble* of plants, which must have been produced under circumstances different from those which pre-existed, replaces the old vegetation. The four great periods are as follows:—

- A.—*The First Period* includes the coal measures, and all the strata containing organic remains which lie below them. (M to Q. Diagram, No. 1.)
- B.—*The Second Period* comprehends the vast deposits of red sandstone, magnesian limestone, and a sandstone lying above that limestone, called the new red sandstone. (L and part of K.)
- C.—*The Third Period* commences with a kind of shelly limestone, that forms a member of the upper part of the group of red marly sandstone (K), and includes all the superior secondary strata up to the chalk. (G to I.)
- D.—*The Fourth Period* includes all the strata more recent than the chalk. (C to F.)

It is a remarbable circumstance that the periods are separated by strata, which, if not entirely destitute of *land* plants, contain them in very small quantity. Thus A is separated from B by a formation of coarse sandstone (called by geologists the red conglomerate), in which plants are of rare occurrence, and by the magnesian limestone in which marine plants are almost exclusively found: again, B and C are separated by the shelly limestone (muschelkalk of geologists), which is almost destitute of vegetable remains: and, lastly, C is separated from D by the chalk; in which, with rare exceptions, only marine plants have yet been found.

First Period.—The lowest strata in which animal remains are found contain also those of plants, so that it would appear that animal and vegetable life were from the first co-existent. The plants in the older sandstones are for the most part marine, but the impressions are usually indistinct. Black carbonaceous matter, without any organic form, is by no means unfrequent, and sometimes in considerable quantity, and it is not improbable that it is of vegetable origin, for fossil plants are very commonly found in the state of charcoal. It is in the beds of coal, and in the sandstones, clays, and limestones which accompany them, that vegetable *remains first occur* in profusion, and there are few phenomena in geology more remarkable than those enormous accumulations of vegetable matter from which the coal-beds have been derived. The most distinguishing feature of it is the great numerical preponderance of the third class—viz., the vascular cryptogamæ, and the prodigious size which the plants attain. They constitute five-sixths of the whole flora of the period, while they do not form the proportion of one-thirtieth in the vegetation of the present time. The ferns of temperate regions are low plants with stems rising scarcely a few inches above the ground, but in the equatorial regions there are what are called tree-ferns, which have a stem from twenty to thirty feet high. Now the different kinds of fossil ferns of this period often correspond with the tree-ferns of the tropics, as is attested by the remains of their stems, which are occasionally met with. The plants called lycopodiums by botanists constitute another order of this class, and are of a kind intermediate between tree-ferns and the fir-tree tribe. Those now existing never exceed the height of three feet, and are usually weak prostrate plants, having the habits of mosses; but the fossil lycopodiums attain gigantic sizes, stems having been found above three feet in diameter, and seventy feet long. There is in this period a much smaller proportion of the fourth and fifth classes, in comparison with what occurs in existing vegetation; and, with the exception of the fir tribe, which was very common, the existence of the dicotyledonous class is little more than conjectured. The plants which constitute by far the larger proportion of the flora of the first period belong to genera which exist, of such dimensions, only in the warmest countries of the globe; and it is evident, therefore, that the climate of the north of Europe and America must have been at least as hot as that of the equatorial regions, at the time the plants grew which are now buried many fathoms under ground in the coal-mines of those countries, for all the circumstances attending them exclude the idea of the plants having been drifted from southern latitudes into those situations.

Second Period.—The red sandstones which were deposited so extensively at this period are even more destitute of vegetable than they are of animal remains. This absence of organic remains is a very remarkable and inexplicable circumstance, considering the great extent occupied by these deposits in all countries, and their vast thickness. The plants hitherto found in the lowest strata of the period have been almost exclusively marine, the few exceptions being vascular cryptogamæ, resembling those of the first period. In the superior beds, a few of the coniferæ or fir-tree tribe have been found, and some that are supposed to belong to the monocotyledonous class.

Third Period.—The lowest stratum of this period contains very few plants, and these chiefly marine; but they become more abundant in the sands, sandstones, clays, and limestones that succeed each other in numerous alternations up to the chalk. Many belong, however, to an entirely new race of plants from any which had previously existed. There are no longer the gigantic ferns and lycopodiums of the first period,—the same families exist, but the character of excessive luxuriance disappears, and species analogous to plants—now natives of the Cape of Good Hope and New Holland—become common. The whole of the flora of the period consists almost exclusively of the third and fourth classes, and nearly in equal proportions: the rarity of the fifth and sixth classes, that is, of monocotyledonous and dicotyledonous plants, is very remarkable. Among those belonging to the fourth class, viz. the gymnospermous phanerogamæ, there is an extraordinary preponderance of the family called *cycadeæ*, a family scarcely so numerous now over the whole globe as it was then in the small part of Europe where its fossil remains have been found: it constitutes now not above a thousandth part of existing vegetation, whereas it forms one-half of what remains of the flora of this period. The chalk, which constitutes the upper strata of the period, has not afforded as yet more than a few marine plants, and scarcely a trace of land plants, so that a complete change had taken place in the nature of the country surrounding those parts where the chalk was deposited, from what had existed immediately before.

Fourth Period.—From the termination of the deposit of the chalk formation, we discover in the animal and vegetable remains the commencement of resemblances to species which now exist; the proportion gradually increases in the newer strata, until, at last, the flora of the latest tertiary deposits differs very little in character from that of the present time in the same countries. In the beds immediately above the chalk, ferns and cycadeæ again appear, but in greatly diminished proportions; the coniferæ, but very different from those of the older periods, increase in quantity, mixed with palm-trees and others of the monocotyledonous class of tropical regions, associated with dicotyledonous trees, such as the elm, willow, poplar, chestnut, and sycamore. We again meet with local deposits of decayed, or rather altered, vegetable matter, forming thick beds of a kind of coal, which is used in many countries, as on the banks of the Rhine, for fuel,—something intermediate between coal and peat.

This geological sketch has extended to a much greater length than we originally intended. We have endeavoured to compress it as much as possible, and are apprehensive that the subject may still appear to some readers very obscure in many important points. In this sketch we lay no claim to originality: it is, on the contrary, simply a compilation from a popular treatise on geology, which appeared some time ago in the *Penny Magazine*, from the pen of an eminent geologist, but is only therefore the more deserving of respect, as the statements and the reasonings which it contains were not written with a view to support or coincide with this theory, and cannot be suspected of leaning towards it with an undue bias. Those who may wish for fuller information are referred to the works of Baron Cuvier, "Lyell's Principles of Geology," and an excellent work on the geology of England and Wales, by Phillips and Conybeare.

We will now conclude with a short review of the principal facts and conclusions to which geologists have arrived, and compare them with the leading principles of our theory.

1. *Age of the World.*—We learn from geology, that, prior to the creation of man, the earth had existed, and had been covered with innumerable species of living beings, for a long series of ages; to which we are unable, and, pro-

bably, shall ever remain unable, to fix any definite limits.—This agrees with our theory.

2. *Change of Temperature.*—We also learn, that, during the deposition of the inferior beds of the secondary strata, the climate of the north of Europe was many degrees hotter than the West Indies. Specimens of rocks have been brought from Melville Island, the remote northern land discovered in the late polar expeditions, some of which contain, imbedded in the stone, portions of plants belonging to an order now known only to exist in the warmest parts of the equatorial regions. This we attribute to the decreasing activity of the galvanic circle flowing through the earth's external crust. We know that, by the action of the galvanic circle, heat is evolved in proportion to the intensity of the action; that, when very intense, it will melt the most refractory substances, and that it exhausts itself in a ratio corresponding with the degree of its intensity. Upon this principle we hold that Uranus is from his innate heat the warmest of all the known planets, and that, in that respect, Mercury is probably the coldest.

3. *Inclination of the Stratified Rocks.*—Geologists refer to volcanic action to account for the inclination of the strata; and it must be admitted, that, in some cases, this accounts for the appearances very satisfactorily, but in a great majority of instances it is found that *the lower members of the stratified rocks have not been disturbed from their horizontality to the same extent as the superior strata:* the lower members are often found on a level foundation, the strata lying immediately upon them being in a highly-inclined state. Now it is evident, that, if volcanic action had been the cause of the inclination, it could not have disturbed the superior strata, leaving the inferior beds undisturbed, seeing that the lower strata are nearest to the supposed disturbing force. Some other mode of accounting for these appearances must therefore be discovered. A natural section of the stratified rocks often presents to the mind the appearance of immense fragments of extraneous matter, scattered upon the surface of the earth, having fallen in every possible *form and position.*

This view of the case receives considerable support from the oblate figure of the earth: it is computed that the earth's diameter is twenty-seven miles less from pole to pole, than if measured through the equator; a considerable portion of this excess in the equatorial diameter is, according to our hypothesis, to be ascribed to the depositions of the several satellites that have been at different periods scattered upon the earth's surface. This may easily be conceived, if it be considered that any adventitious substance, scattered upon the surface, would be naturally drawn towards the equator by the earth's rotary motion. It is also extremely probable the orbits of the satellites and the earth's equator were nearly coincident, which may further account for the great excess in the equatorial diameter, as under these circumstances the deposition of the satellite must necessarily have taken place within the tropics. And, further, this view will be very much strengthened, if we take into our consideration that nearly all the ranges of very lofty mountains are within or near the tropics; that they decrease in altitude as we recede from the equator, and that near the poles there are no elevations of any magnitude.

4. *Derivation of the Secondary and Tertiary Rocks.*—Geologists consider that the primary strata enveloped the earth somewhat like the coats of an onion: that this envelope was broken and elevated by a force acting from beneath; and that in the valleys and hollows thus formed the secondary strata were deposited; the matter necessary for their formation being derived from the elevated parts of the primary strata, and that in this manner all the strata have been deposited; elevations and depressions of the strata sometimes intervening between the several depositions. We have only one remark to make upon this, with which we will conclude our geological observations. The secondary and tertiary strata contain rocks of a totally different character, as regards their mineral composition, from any that have been observed among the primary rocks; it is, therefore, evident that the whole of the secondary rocks could not have been derived from the primary, seeing that the former contain matter which is not to be found in the latter.

Before we conclude, we would direct the attention to a very remarkable inequality in the moon's motions, called by astronomers her secular acceleration. As this article has already extended to so great a length, we shall make no comment upon it, but leave the reader to draw his own conclusions. It appears, that "it is to Halley that we owe the first suspicion of this very important fact regarding the moon's motions. It had been hitherto the universally received doctrine that all the planets, without exception, were subject to such inequalities only as are renewed within a certain space of the time, and which, on that account, have been called periodic inequalities. The mean motion is determined by a comparison of the planets' places, at very distant times embracing a great number of the periods, within which the inequalities are renewed, so that the result obtained is quite independent of these inequalities. No astronomer had ever ventured to doubt the uniformity of these mean motions; and, in fact, we now know that the major axis, and, consequently, the periodic times of the primary planets, are not subject to any but the periodical inequalities of which we have spoken. But this is not the case with the moon. The mean motion of that satellite is continually accelerated; and as this acceleration, though, mathematically speaking, it has a limit, yet will continue for perhaps many thousands of centuries, it is called the secular acceleration, to distinguish it from those inequalities which have a period that falls within the limits of observation. The cause of this phenomenon was discovered by Laplace; the fact itself was first suspected by Halley. The reality of it was disputed for a long time, but it is now incontestably established. The mean motion of the moon, as determined by modern observations exclusively, is between three and four minutes more rapid than that found by comparing modern observations with the eclipses observed at Babylon 700 years before Christ; and this result is fully confirmed by two eclipses of the sun, and an eclipse of the moon, observed at Cairo, by Ibn Jounis, towards the end of the tenth century."*

We presume that the geometrical demonstrations of the Newtonian philosophy will not be effected by this theory. Whether we ascribe the effects to the agency of electricity, a power of whose existence we are assured by the evidence of the senses; or whether we refer them to gravitation, a conventional term adopted for the purpose of explaining a certain effect resulting from no known cause. If each of the powers be allowed equal to the observed effects, the demonstrations cannot be affected by a mere change of terms. We ought never, at any time, to rest satisfied with the present state of knowledge, or conceive that all the mysteries and laws of nature have been unfolded and expounded. There are many important principles yet to discover, of which we little dream at present, for, as has been truly and beautifully observed by a modern writer, "Between the ultimate point of discovery, and the place we now occupy on the ascent towards it, the steps are so inconceivably many, that, with regard to us, they may be most truly described as interminable. So far as we have experience or can conceive of knowledge, it is an expanse ever widening before us and around us. Its horizon seems not only always as distant as ever, but always becoming more distant the more we strive to approach it. For every one discovery is merely the opening of a road to other discoveries, and the lifting of us, at the same time, to a new eminence, from which we see a broader domain than before, both of the known and of the unknown."

We will here take our leave of this subject for the present, recommending it to the attention of your scientific readers and correspondents. There appears to our mind such a universal consent and agreement in all the different parts of this hypothesis, that the conclusion is forced upon us, that it will at some future time be received as the true system of the universe. T. S. M.

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THE BRITISH MUSEUM.

Sir,—As a Committee of the House of Commons has lately been appointed to continue the inquiry of last Session into the affairs of the British Museum, it is to be hoped that some regulations will be made respecting the opening of the house on Good *Friday*, and in the *Easter*, *Whitsuntide*, and Christmas holidays. There are thousands of persons who re unable to visit this establishment at any other time, and why should they be excluded from this agreeable recreation and instructive promenade? It is objected by the Principal Librarian, in his evidence (No. 1,319), that the Museum must be thoroughly washed and cleansed in these three weeks, that the house may "smell wholesome," and that the "fleas" (No. 256) may not inconvenience the readers!!! But why select these identical weeks for this purpose? Why not close the Museum in the week *after* the Easter, Whitsun, and Christmas weeks respectively, if such extensive purgations be necessary? But with six or seven housemaids, might it not be cleansed every day before breakfast? The "vulgar class" (No. 1,321) and the "mischievous portion of the population" (No. 1,320) are abroad at this time, continues the same officer, and "people of a higher grade would not like *to come to the Museum* WITH *sailors from the dock-yards, who might bring their girls with them*" (No. 1,329). And what if they did, so long as they behaved properly! That able legislator, Mr. Ewart, suggested lately, in the House of Commons, that the Museum should be accessible to the public on SUNDAYS, and why not allow this after one o'clock? The luxurious Aristocracy are at liberty to revel in the delights of *their* Eden, the *Zoological Gardens*, on a Sunday, and to amuse their fair partners, or "girls" if you please, by explaining to them the various habits of living animals, not always the most *delicate*, particularly those of the monkey tribe bearing so close a resemblance to their monkey-jacket friends of the West-end; they have all this, and more still—they have their numerous magnificent CLUBS, provided with every indulgence that wealth can purchase—as well as the splendid LIBRARIES of Clubs, where *they* may lounge and yawn away the whole of *their Sunday*, or peruse any book they please, from the Bible to Voltaire: but the common people, forsooth, the "vulgar class," the "mischievous population," *must* go to church three times a day, or get drunk at the ale-house; not being rational beings, of course they need no rational recreation!! Their crime is, to be *poor*, though industrious; they have lost caste, and must be *kept* down to *their* situation in life. But these things *must* be altered; the *people are no longer serfs* or slaves, and cannot *now* be treated as such! They have an undoubted right fairly to enjoy *that* to the support of which they all contribute their mites, however small they may be. Another accommodation might readily be granted to the public—an EVENING READING-ROOM might be built, where thousands would go to consult *their own books*, for such they are. How many tradesmen and professional men, what numbers of the industrial classes, would hail this as the greatest boon the Government could bestow!! The Principal Librarian says (No. 1,313) the Museum was not intended for *lawyers' clerks*, at least not for their principal accommodation; and that *merchants' clerks* (No. 1,314) would find all they wanted in circulating-libraries. The Rev. Secretary says (No. 1,303), that the Museum is "rather too much than too little used!!" As a further instance of the *aristocratic* nature of this establishment, it may be stated that the chiefs of departments, when they go before the Board, *stand* during the whole time (Nos. 2,960, 3,701). Before Committees of the House of Commons a chair is always given to the witness; but we suppose his Grace the Archbishop of Canterbury considers himself to be the King of the Museum! What folly! This should be altered.

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* *History of Astronomy of* the Library of Useful Knowledge, p. 80.

The subject of an *Evening Reading-room* was broached by one of the Committee last Session, and its practicability was clearly demonstrated. Indeed, it is now admitted that there is a necessity for an entire reform in every thing relating to the British Museum; and that an enlightened philosopher, Sir HUMPHREY DAVY, *for several years a Trustee of that establishment*, and perfectly acquainted with its management, was of the same opinion. Writing from Rome in 1829, he says,* what is equally true *now*:—"There must be a general system of change in *every thing* belonging to this Institution before there can be any system of *radical* improvement! It appears to me, that the present moment is the best moment for attempting a *radical* and fundamental change *in every thing* belonging to this ancient, *misapplied*, and I may, almost, say, *useless* Institution. *In every part of the metropolis, people*

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* Davy's Life of Sir Humphrey Davy, vol. ii. pp. 342—344. The whole passage is quite worthy of a place in the Mechanics' Magazine.

are crying out for Knowledge; they are searching for her even in corners and byeways; and such is their desire for her, that they are disposed to seize her by ILLEGITIMATE MEANS, *if they cannot obtain her by fair and just ones. This, then, is the moment to give energy to their efforts, and for the* LEGISLATURE *to sanction, what* REASON *has so long required.*"

I am, Sir, yours, &c.,

THE FRIEND OF THE INDUSTRIAL CLASSES.

ENGLISH AND AMERICAN STEAMERS— AVERY'S ROTARY-ENGINE.

Sir,—I should feel obliged for further information, through the medium of your Magazine, from some of your many American readers, relative to Avery's recoil-engine, and also a New York steamer, mentioned in the *Encyclopædia Metropolitana*, the De Witt Clinton.

The cylinder of the De Witt Clinton is 66 inches diameter; 10 feet double strokes; revolutions, 26 per minute; effective pressure, 12lbs. per square inch on the piston—323 real H. P. Is it not a mistake to call it 646 H. P., as nothing is said of two engines, and one is more powerful than any at work in England *at present*. The Radamanthus is 220 nominal H. P.; has two engines; 55 inch cylinders; 10 feet double-stroke, 20 per minute going together with low steam; say effective pressure 10lbs. per square inch on piston—about 290 real H. P. The De Witt Clinton draws only 4 feet 6 inches water, and ought to be impelled by one such engine faster than any sea-going boat in Europe, at least before the wind. Four valves are mentioned 17½ inches in diameter; the number required for a double-acting engine. How are these managed with 20lb. steam per square inch on the safety valve? That the thing is well managed in America I doubt not; the load must be near three tons on each of the steam valves, unless they are balanced as in Watt's plan, or made like Hornblower's double-seated valves, such as are used in Cornwall; or Tredgold's packed cylinder modification; or according to some other similar plan. The expression, "steam 20lbs. per square *inch on* the safety valve, *expanded inch cylinder*, *10lbs average*." I presume means steam 20lbs per square inch on the safety valve, expanded in the cylinder to 10lbs. average. The engine apparently works expansive—how much is the question? Do the Americans usually follow their consul's example, as given in the *Edinburgh Review*, and divide the lbs. per square inch on the safety valve for expansion? In this case, I shall assume 30lbs. pressure on the piston per square inch; expanded, perhaps, to 22lbs.; rather high for condensing. Or, is the steam cut off at one-third? If so, this would give 10lbs. per square inch pressure, or 4lbs below atmosphere, at the end of the stroke, or an expansion of three times, and an efficiency of gross power of about 18¾lbs. per square inch on the piston. But this would scarcely produce 12lbs. ditto effective pressure; while the first plan gives rather too much. A corrected statement would oblige, and is requested.

The following estimate was made on the first appearance of the account of Avery's engine, for a gentleman who had some idea of erecting one to work a small circular saw, to cross cut barrel-staves, &c. All the difficulties of the quantity of fluids issuing from a given aperture, at a given pressure, are avoided; as the estimate is founded on the possible effective power which can be produced by the fuel used. Both the weight of the fuel, one-half of wood, and the time of consumption, must be assumed, in consequence of the defective account. In mining engines, 24 hours is a day; in manufactories sometimes only 12 hours, which I assume; and, taking half a load as half a ton, or 1,120 lbs., and *oak* to coal being (see "Engineers' Pocket-Book) as 1,089lbs. to 600lbs., the fuel is equal to 618lbs. of coal; and 7lbs. of water evaporated per lb. = 4,326lbs; say 70 cubic feet of water. The steam in lbs. per square inch, on safety valves, is 80lbs + atmosphere 94¾ lbs. pressure; = to 13,500lbs. do on the square foot, × 310, about the volume of steam due to one of water (see Tredgold) at 6⅓ atmosphere, then we have 4,185,000lbs. × 70 = 292,950,000lbs., one foot high efficiency for 12 hours = 39,300 −, 1 atmosphere wasted = 32,750lbs. 1 foot high per minute. Taking, however, two-fifths of this for effective power, we have about 4-horse power for 12 hours, for half a load of oak-wood. It appears from Mr. Davies Gilbert's investigation, that the effective power can, in no case, exceed half the efficiency; and that, for this, the velocity of the motion of the aperture, at the end of the arm, must be three-fourths of that due to the steam pressure, or a velocity about equal to a cannon shot. The velocity of 37 660 feet per minute is not half that which is most effective; though it must be admitted that four hundred and twenty miles per hour is *considerably fast*. The American engine seems just within the limits of possibility, since the power is five times that assumed by Mr. D. Gilbert, and the velocity so much less, that iron arms may be just enabled to withstand the centrifrugal force. More facts of work performed are requested. The principle of recoil is the first known application of steam power, though for useless purposes; but the execution of *duty* will reflect credit on American ingenuity; the more so from the well-known and frequent failures of similar attempts in Europe. The advantages of expansion, however, must be abandoned, even if Avery's engine should chance to rival the *common* high pressure engine, not worked expansively

How to observe requires an observation, and deserves more. The distinction between steam pressure and steam in lbs. per square inch, on the safety valve, should be attended to (the gross pressure in the cylinder, as well as the effective ascertained is known). This is equally required for high pressure engines, since the wasted atmosphere is one-third of the efficiency or gross power of steam of 30 lbs. per square inch on the safety valve, and one-fifth of steam of 60lbs. ditto; and, in all cases, if worked expansively, it should be stated at what part of the stroke the steam valve is closed. Believing that many American steam-boat engines (from various hints, however, rather than statements) are worked expensively, I am desirous of information as to what extent expansion is there in practice carried, when acting against an uniform resistance.

Yours, &c.,

E.

Mines, Cornwall, Feb. 16, 1836.

MR. HERAPATH'S RAILWAY THEOREMS.

Sir,—In one of my old note-books I find the following requisites stated to be necessary for obtaining a solid knowledge in mathematical and physical science:—

> "A reverential adherence to the principles of truth; sound judgment; a temper that is not easily ruffled; patience in investigation; and a modest and proper diffidence in our own understanding."*

Had Mr. Herapath thought and acted upon some of the above principles before he promulgated his numerous articles and mistaken discoveries on railway locomotion, he might have saved himself from the severe (but just) castigations he has received from the strong-of-hand H., and also from Mr. Meredith, of Cambridge. But Mr. Herapath, or his "injudicious friends" (save us from such friends), were determined to uphold his infallibility even at the prodigious discount of honest truth. And now, Mr. Herapath, I shall address a few words to yourself.

I have asserted more than once (and three others have done the same), that you, Mr. Herapath, Anti-Carper, and A Looker-on, are identical. Well, this assertion must be either true or false. If false, you surely must have read their articles in the *Mechanics' Magazine*; and if you really do possess a moiety or even the hundredth part of the mathematical attainments you arrogate to yourself, you could not have failed to observe their lack of knowledge in common arithmetic, as well as their profound ignorance of algebra and physical science. Then, supposing this to be the case, let me ask you, why did not you at once denounce them? The answer, I am afraid, is easily given—they ministered to your voracious appetite for vanity. But to suppose that you, Mr. Herapath, Anti-Carper, and A Looker-on, are three distinct persons, and unknown to each other, is just about as probable as if twenty dice were thrown, they should all turn up aces.

Now, Mr. Editor, with your leave, I must take notice of Mr. Herapath's theorems for ascending planes; and as a beginning to this part of the subject, I shall propose and solve the following question :—

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* Notes from Professor John Robinson's "Lectures on Natural Philosophy." Edinburgh: 1803.

Suppose an engine is calculated, when exerting her full mechanical powers, to pull a certain load up an inclined plane of 1 in 250; also, that the maximum speed on a horizontal plane is 30 miles per hour. Then, suppose with this velocity the engine and train begin to ascend a plane of 1 in 200. Required the time in going over one mile, and also the velocity at that period, and supposing the plane to be of an indefinite length, how far can they proceed before they come to a stand still, allowing friction to be $8\frac{24}{25}$lbs. per ton.

Solution.—1 ton = 2,240lbs. and 2,240 $\div 8\frac{24}{25} = 250$, that is, a descent of 1 in 250 will just balance friction.

Assume $250 = a$, $240 = b$, also $\frac{1}{b} - \frac{1}{a} = \frac{1}{\text{C}}$, then $v = \sqrt{\text{V}^2 - \frac{2g\text{S}}{\text{C}}} \cdot \frac{15}{22} = \sqrt{44^2 - \frac{64\frac{1}{3} \times 5280}{1000}} \cdot \frac{15}{22} = 39{\cdot}954 \times \frac{15}{22} = 27{\cdot}241$, that is, the velocity at the end of a mile is 27 miles 424 yards per hour, and $t = 60 \div \frac{1}{2}(30 + 27{\cdot}241) = 2{\cdot}096$ minutes, or 2 min. $5\frac{3}{4}$ seconds; also when $v = o$, then $\text{V}^2 - \frac{2g\text{S}}{\text{C}} = o$ $\therefore$ $\text{S} = \frac{\text{V}^2\text{C}}{2g} = \frac{1936000}{64\frac{1}{3}} = 30093$ feet = 5 miles, 1231 yards; also $t = \frac{\text{V}\,\text{C}}{g} = \frac{264000}{193} = 1367{\cdot}87$ seconds = 22 min. 47·87 seconds; and the average velocity when the engine and train come to a dead halt will be $\frac{30093}{1367{\cdot}87} = 22$ feet per second, or 15 miles per hour.

I am, Sir, yours, &c.

IVER M'IVER.

Feb. 23, 1836.

P. S.—In my last article, p. 395, col. 1, *for* $S = \frac{\text{V}^2}{2g\,\text{S}\sin. i}$, *read* $\text{S} = \frac{\text{V}^2}{2g\sin. i}$; *also, in the* same column, for "a negative velocity of $2\frac{9}{11}\sqrt{-113}$," read "an imaginary velocity, &c."—I. M.

HISTORICAL RETROSPECT OF THE CAOUTCHOUC MANUFACTURE.

In every view the rise and progress of a new manufacture is an interesting object of contemplation, and especially so when employed on a new material. Whether we consider it as indicating the progress of man in subduing the powers and properties of nature to his uses, or as establishing by new instances the adaptedness of the material creation to the supply of our wants and the improvement of our faculties; or as furnishing new ties of brotherhood between men and nations by the mutual dependency for the gratification of new desires; or as evidencing the illimitable increase of human wishes and efforts; or as showing the beneficence of the providential movements by which the skill, the perseverance (perchance the infatuated perseverance) of one man in a far-off corner of the world provides a market for the labour of thousands, wandering before in wild and naked want, and gives in return, knowledge and civilisation, and their countless and inestimable consequences: In any of these aspects the adaptation of a new material to the wants or even the whims of civilised society is an event full of interest to the philosopher, the patriot, and the Christian.

The struggling inventor himself is usually beset with cares and difficulties. To extort from nature her secrets, and to riddle out of the heaps which art has gathered, the precious grains of knowledge that he needs, to bear the jeers of the ignorant, the superciliousness of the purse-proud, and the pitiful advice of the prudent: these are his toils and his trials —troubles sweetened only by enthusiastic hope, the confident conviction of yet unseen success "which maketh not ashamed."

When his plans are fully before the world, and incredulity can no longer deny his success, nor ignorance itself mistake it, unmoving prejudice stands across his path, and forbids him his reward. His trials, however, have taught him to triumph by perseverance; public opinion pronounces his title to recompense; when some foul, lurking, perhaps wealthy, plagiarist, shrinking from no villany if it be but gainful, seizes on some quirk of law, robs him of his right, and employs his scoundrel purse to defend the rank iniquity.

Such is too often the history of inventions and inventors. We have been reminded of some of its features by the inquiries, recent and unexpected events have induced us to make into the progress of the manufacture of caoutchouc.

This substance seems to have been first brought into Europe, or at least to have attracted the attention of men of science, about the middle of last century. It was then imported, and, indeed, known only in the solid state; and it was not till many years after it was first received, that it was certainly known not to be an artificial production. Several French philosophers examined it, and gave memoirs upon it; but its use was confined to the well-known one of rubbing out the marks of black-lead pencils, from which it derived its name of Indian rubber. A letter of Dr. Priestley's mentions it as a rarity, and says that it was sold by Nairne, of the Royal Exchange; the price of a cube of about half an inch on a side being three shillings and sixpence—somewhat more than 40*l.* avoirdupois pound.

If, however, little had been done in rendering this singular substance generally useful, it is amusing to observe how much was hoped for. The following paper, given by Dr. Anderson in the *Bee*, of March 23, 1791, shows, both by the minuteness of description thought necessary, and the extravagance of the hopes avowed, how little was then really known on the subject:—

> " The substance which forms the object of our present disquisition is called *Caoutchouc*, by the natives of the country where it is spontaneously produced. It is denominated elastic gum, or elastic resin, by philosophers in Europe; but it is now known in the shops by the name of Indian-rubber; a substance that few of our readers are not acquainted with. It is a firm, tough, pliable substance, greatly resembling some kinds of leather; but it possesses a degree of elasticity that cannot be equalled by any known substance in nature. It admits of being stretched out in every direction to an *astonishing degree*; and when *the distending power is removed*, it recovers *its former shape and appearance*. It neither can be dissolved in water, in ardent spirits, in acids, nor alkaline liquors, in the ordinary state of our atmosphere. Oils, in some measure, act upon it; but the vitriolic ether is the only complete solvent of it that is as yet known. It is inflammable, and burns with a clear steady flame, emitting then a slight smell, not at all disagreeable. When exposed to a cold air, it is more hard and rigid than under a milder temperature; but it neither becomes fluid, nor loses its elasticity, till it be exposed to a much more intense degree of heat than is ever experienced in any climate on the globe. It may, however, be melted by a very intense degree of heat; and then it assumes a thick viscid appearance, like some kinds of semi-fluid oils. And having once been reduced to that state, it cannot be again made to acquire its former consistence or elasticity.
>
> " This substance is now well known to be the inspissated juice of a tree. The natives in those regions where this tree abounds, extract the juice by making longitudinal incisions in the bark. It bleeds freely, and the juice, in a thick state of semi-fluidity, is collected into vessels placed to receive it at the bottom of the tree. It is then, by means of a brush, spread upon moulds prepared for the purpose, and suffered to dry in the sun, or before a fire, which, by evaporating the moisture, soon brings it to the state in which it is sent over to us. By adding successive layers above each other, it may be brought to any degree of thickness wanted; and by varying the form of the mould, it may be made to assume any shape or appearance you incline; which shape, as has been said, it will ever afterwards retain, if no distending force be applied to alter it.
>
> " From this simple detail of facts, it is easy to see, that the uses to which this substance might be applied in arts and manufactures are innumerable, and such as can be effected by no other known substance in nature. Yet so blind have mankind hitherto been to these advantages, that no attempts have been made in any accessible region where extensive manufactures could be established, either to cultivate the tree that produces it, or to induce the natives to send the juice in its fluid state to Europe, where it could be properly manufactured. All that has been done is, to suffer the natives to mould it into the form of a small kind of bottles, which is found to answer some purpose among themselves; and these, when brought to Europe, are applied to scarcely any other use than being cut to pieces for the purpose of effacing marks made upon paper by a black lead pencil, or that of idly amusing children by stretching it out, and observing how perfectly it again recovers its pristine form, after having been distended to

a great length in any direction. We amuse ourselves with the phenomena without profiting by it, as children used to be amused with the attraction of amber, before the phenomena of electricity were explained.

"It is now time that we should begin to make some use of this very valuable substance, which, probably, a hundred years hence, will administer in a variety of ways to the accommodation of our descendants. With that view, I shall here venture to point out a few of the useful purposes it may be made to answer; not doubting but the invention of men, whenever they can get the materials in their hands in abundance, will discover a variety of other important purposes it will serve, that have not as yet been dreamt of.

"1st. This substance so much resembles leather, that it naturally occurs, that it might be employed for the purpose of making boots. These would not only admit of being made of the neatest shape that could be imagined, but also, by being impervious to water, or the other corrosive liquors abovenamed, would be sufficient to protect men from wet, though standing in water. For seamen, fishermen, and others, who are by their business obliged to wade in water, such boots would be of the greatest utility. The feet and legs might thus be protected from the action of even acids or alkaline substances themselves, wherever that should become necessary.

"2nd. *Gloves* of this substance would be so soft and pliable, as to allow the fingers perfect freedom of action; and in those kinds of businesses, that require artificers to put their hands among acids or corrosive liquors, they may become highly convenient.

"3rd. *Caps*.—The uses that might be made of this substance for defending the head from wet are infinitely various, and might prove highly beneficial. A thin covering of this substance might be made for travelling hats, which, without adding any sensible weight, would be perfectly impermeable by wet of any kind. Every other kind of covering for the head might be thus rendered water-tight, merely by giving them a slight coat of caoutchouc, which would in no sensible degree alter their other qualities. Bathing-caps, in particular, could thus be made extremely commodious, and at a small expense. This could be done, by covering with a coat of caoutchouc an elastic stocking-cap, which, merely by being pulled tight over the head, would embrace every part of it all round,so as to prevent the entrance of water. The stocking and the covering being equally elastic, they would contract and expand together without any sort of difficulty.

"4th. *Umbrellas.*—Neck-pieces of silk, or other materials, cloaks or travelling coats of any sort, that should be judged proper, could thus be rendered perfectly water-tight, without destroying their pliability in the smallest degree. It would only be necessary to cover them with a coat of this soft varnish after they were made, so as to close up the seams. Buckets, too, all of canvas, or any other cheap substance, might be made water-tight and incorruptible, by merely covering them with this matter. Vessels also for holding water and other liquors, that would not be liable to breakage, might thus be made of any size or shape at a small expense. In short, it would take too much room to attempt to enumerate half the uses that might be made of it in the household way.

"5th. In the army and navy, its uses would be still more numerous and important. *Tents* are an article of very great expense: the canvas for them must be of the very best quality and closest texture; and after all, they are seldom proof against continued rain. At any rate, the vicissitudes of weather soon rot the canvas, and make a new supply in a short time be necessary. Were these tents covered with a coat of this substance, the entrance of rain through it would not only be altogether precluded, but also, the very wetting of the canvas itself would be prevented, and, of course, its durability be augmented to a tenfold degree. On the same principle, the sails of a ship would not only be made to hold the wind in the most complete manner, but by being covered by a thin coat of it on both sides, the sail-cloth itself could never be wetted, and, of course, its durability be augmented, while its flexibility would not be diminished. Other uses to which it could be applied in the army and navy, are so numerous, as not to admit of being here specified. It is only necessary barely to mention, that on a military expedition, to have a vessel capable of containing fluids, which, when empty, admits of being wrapped up like a handkerchief and put into the pocket, might, on some occasions, be of inestimable value; and the same at sea.

"6th. *Aerostation* is now nearly at a stand; but it is wonderful that no one ever perceived the use that might have been made of this substance for that purpose. No kind of silk, or other light substance, could ever be found, that possessed the smallest degree of elasticity; by consequence, when they ascended into the higher regions, the expansion of the gas was in danger of bursting the globe; it was therefore necessary to leave it open below to guard against that accident. A globe of caoutchouc would have possessed the quality here wanted; it would have expanded as the circumstances of the case required; and while it was perfectly tight, prevent the involuntary escape of the smallest quantity, it would have adapted itself in size to every variation of circumstances. It is true, the retentive power of this substance, when very thin, has never yet been ascertained by experience; but there is reason to believe it is very great.

"7th. As this substance is inflammable, and burns with a bright flame without requiring any wick, it might be employed perhaps with great economy as torches or flambeaux. Solid balls have also been made of it, that are light, and of an amazing degree of elasticity; but what useful purpose could be made of these, does not at present appear. It might also be moulded into the form of riding-whips, and would probably answer that purpose admirably well; and after they were wore out, they might be employed as torches.

"8th. As a material for chirurgical purposes, it might be employed on many occasions. *Catheters* have already been made of it, after having been dissolved in ether, that have been found to answer the purpose wanted, and to occasion much less irritation in the parts than those of any other sort that have yet been tried; but the great price, when thus manufactured, prevents them from coming into general use. The little bottles, when applied to the breasts of women distressed with sore nipples, can be so managed, as to occasion a more gentle suction than can be effected any other way, and have therefore afforded very great relief. In short, the variety of uses to which they might be applied, as bags for injecting or for sucking, are too numerous, to admit of being here so much as pointed at.

"9th. *Elastic Springs.*—In all cases where a spring is wanted to act by its *contractile* power, no substance can be conceived more proper than that of which we now speak, especially in cold climates; and there are innumerable cases in which it might be employed in this manner with the happiest effect, in various kinds of machinery.

"10th. It is many years since Dr. Bergius at Stockholm, made some experiments on this substance in Papin's digester. By subjecting it in that way to an intense degree of heat, it is said to have been converted into a hard, elastic, horn-like substance. I have not heard that these experiments have been repeated; but if upon further trial this shall be found to be invariably the result, it would extend the utility of this substance far beyond the limits we have hitherto thought of; but in the state of uncertainty that at present prevails on that head, it would be improper to say more.

"I might go on at this rate for many pages together, *pointing out* various other *uses to which it might be applied*; but I shall content myself with specifying one other only.

"Geographical globes are at present an article of great expense, especially when of such a size as to admit of exhibiting a tolerable view of the earth's surface. These could be made of caoutchouc of any size required, at a very moderate expense. The savages of America, whom our philosophers represent as destitute of every mental endowment, will teach us the way of proceeding.

"The little bottles we import from thence, are formed upon moulds of clay dried in the sun. When the caoutchouc has hardened on the surface by the process already described, a little water is introduced at the mouth of the bottle, which gradually softens the clay, and in time allows it to be washed entirely out of it. A globe of clay might be easily moulded of any dimensions required, leaving at one of the poles a small protuberance for a little neck. This ball, when dry, might be covered with caoutchouc till it acquired the thickness required; and for the purpose here wanted, this might be very thin. The clay might then be washed out, so as to leave it empty. The remainder of the process might be here described, were I not afraid of encroaching too much on the patience of the reader.

"It now only remains, I should give the reader some notices concerning the tree that produces this singular substance.

"In no one instance that I know has the inattention of mankind to useful improvements been more conspicuous, than with respect to the object of our present discussion. It is not much less than sixty years since Mr. de la Condamine first made known to Europeans this singular substance, which possesses qualities that obviously render it one of the most useful bodies that hath ever come to the knowledge of man for many important purposes in life; yet the culture of the plant which affords it, has been, till this moment, entirely neglected by every European nation; nor do I believe, that ever a single seed of it was planted by one person in the universe."

Then follows a botanical account of the tree Hevea, from which the juice is obtained.

While the processes suggested in this paper are in some instances not very dissimilar to those since employed, in others they are totally unlike, and have been found utterly useless. The principal scheme was to cover woven fabrics with a film of caoutchouc. To this there were insuperable objections. No substance was then known, which, while capable of dissolving solid caoutchouc, was cheap enough for popular use. Besides, when managed by any process then known, it was left on the surface of the cloth in too viscid and adhesive a state to be at all serviceable. The only hope, therefore, was that the juice might be obtained and applied in its native fluid state, the solid caoutchouc settling upon and adhering to the substance to be coated. With how little success this attempt was attended will be seen hereafter.

It was, however, in the same year (1791) that the first successful trial was made; but it was conducted on a different principle, and its results, though useful, were very limited. The following extract shows the mode of operation adopted by M. Grossart, as explained by him to the Academy of Dijon :—

> " It has been remarked, that if shreds of these bottles fresh cut down be pressed very close upon each other, they may be made to adhere so closely as to appear one piece. This operation is facilitated if the caoutchouc be softened in warm water. Upon this principle he thus proceeds :—After having provided a mould of a proper size for the open of the tube intended, he slices down the caoutchouc into thin shreds, puts these into boiling water; after they have remained there for some time to soften, he takes out these shreds, and rolls them tightly on the mould, taking care to make the edges overlap each other; one shred is applied after another, till the mould is all covered to the thickness wanted, then a ribbon is bound as tightly as possible over the whole, and above that it is still more closely bound by a tire of packthread, laid close to each other over the whole surface. In this state it is allowed to remain for some days, when the packthread is unbound, and the ribbon taken off. The mould may then be easily drawn out after dipping it a few minutes in hot water, and the tube is formed."

Hitherto caoutchouc had been supplied entirely from the American continent; but near the close of the last, or the beginning of the present century, it was discovered that several kinds of plants growing in the East, though very different in appearance from the *hevea* of Mexico, afforded the same substance, or one very much resembling it; and hopes were again raised that extensive use might be made of the juice in its fluid state. Mr. Howison experimented diligently with it, and besides making gloves, shoes, &c., a process practised by the Indians of Para, he proceeded to saturate with it loosely-woven fabrics, such as Cossembazar gloves and stockings:—

> " Having drawn them upon the wax moulds, I plunged them into vessels containing the milk, which the cloth greedily absorbed. When taken out they were so completely distended by the gum in solution, that, upon becoming dry by exposure to the air, not only every thread, but every fibre of the cotton had its own distinct envelope, and in consequence was equally capable of resisting the action of fluid bodies as if of solid gum.
>
> " This mode of giving cloth as a basis I found to be a very great improvement; for, besides the addition of strength received by the gum, the operation was much shortened.
>
> " Woven substances that are to be covered with the gum, as also the moulds on which they are to be placed, ought to be considerably larger than the bodies they are afterwards intended to fit; for, being much contracted from the absorption of the milk, little alteration takes place in this diminution of size, even when dry, as about one-third only of the fluid evaporates before the gum acquires its solid form."

From these experiments, Dr, Anderson anticipated immense benefit to our fishing and commercial interests, from the application of the fluid to nets and cordage; and to the arts, from its use as a varnish. Still, however, there remained the difficulty of procuring it in sufficient quantities; partly arising from the distance and wildness of the places which produced it, and partly from the difficulty of preserving it. He, therefore, strenuously urged its cultivation on the coasts of Africa, as the nearest tropical locality. Nothing, however, came of his zealous and well-meant efforts.

In Nicholson's translation of " Fourcroy's Chemistry," vol. viii. (1804), we have a long article on this substance; its remarkable fitness to many purposes in the arts is strongly stated, and its uses, as it was then employed, are enumerated; but no better expedient for extending its use is suggested than " to import the juice of the *hevea* with caustic alkali added to it," which prevents the elastic " substance from precipitating;" while it is distinctly said, that " it remains adhesive and viscid in the solutions" in fixed oils—that " when dissolved by the oils of lavender, aspic, turpentine, &c., with the assistance of a gentle heat, the viscid combination remains adhesive, incapable of drying, sticking to the hands, and, in fact, of no utility"—and that most of the varnishes into the composition of which it is made to enter by a mixture of fixed and volatile oils, "have the inconvenience of softening and becoming very adhesive when exposed to the rays of the sun or to heat."

That no further advances had been made up to 1807, is rendered highly probable by the circumstance that no mention of the subject is to be found in the immense collection of scientific notices forming the 2d volume of Dr. T. Young's "Lectures on Natural Philosophy," more than is implied in giving the titles of some of the books we have already quoted. Even the substance itself is rarely mentioned, and then with very different views; while the only notice of water-proof cloth is a repetition of Vauquelin's conjecture, that "the operation was performed by means of soap, glue, alum, and a little sulphuric acid."

No further improvements seem to have been attempted before 1820, the date of the first patent taken out by Mr. Thomas Hancock. It will be observed, that, up to this time, no real progress had been made towards rendering caoutchouc available for popular use, owing, on the one hand, to the impossibility of obtaining the liquid juice in a proper state, and in sufficient quantities; and, on the other, to the unmanageableness of caoutchouc when it had once become solid.

Before enumerating the successful modes in which this substance is now used, we must remark that they are founded on its principal properties; viz. its elasticity and its impenetrability to water. Mr. Hancock's first patent was for an application of the former property, and it certainly struck out a new path. He cut the Indian-rubber into strips or threads, and enclosed them in woven or leather cases; the threads thus covered were placed side by side to any width, and an elastic fabric was thus produced, admirably fitted for gloves, braces, garters, girths, and all other purposes where extensibility is desired. This invention not only led to further improvements in elastic webs and braiding, articles now employed to an immense extent, but, *by occasioning an extended use of the substance, and a more familiar* knowledge of all its properties, it prepared the way for the successful efforts of other kinds which followed.

The next patent was also one of Mr. Hancock's, and was dated 1823. It was for using a solution of Indian rubber mixed with pitch and tar, for the preservation of ropes, cordage, and ships' bottoms. The object was to render the pitch tough and elastic in all temperatures.

Mr. Hancock gained another step by discovering a method of making this substance into blocks, and thence into sheets. The variety of uses to which it is applied in these forms is very great, and is daily increasing. It was in the course of these operations that Mr. Hancock discovered that this previous preparation facilitated its solution in essential oils, and (what had escaped the earlier experimenters) the restoration of all its original properties, in nearly or quite their original intensity. Disembarrassed now of its viscidity, and want of strength when applied by dissolution to woven fabrics, he proceeded with experiments intended to prepare for its still more extensive use.

While he was thus employed, Mr. C. Macintosh, of Glasgow, entered the field with his double textures. Mr. Hancock and Mr. M. were, it appears, wholly unknown to each other, even by name, nor was either of them aware of the progress making by the other. They, however, soon became intimately associated; their joint efforts being directed to the improvement of Mr. Macintosh's invention. These double textures are now so well known and appreciated, that nothing need be said in their praise; but it is necessary to state the principle of their construction, and to show how this method differs from those formerly attempted. In the process patented by Mr. Macintosh, Indian rubber is dissolved in coal oil—the mixture being carefully triturated and strained until it is completely cleared of granulous particles: it is then thinly brushed over the cloth, and deprived of part of its volatile menstruum by evaporation. In this clammy state, two surfaces are applied to each other, and the pieces strongly rolled or pressed. If a triple texture is wanted, another fold of cloth is added in the same manner. A further drying drives off the remainder of the oil, and leaves the caoutchouc with all its original properties, inseparably uniting the folds of cloth as a strong, dry, and flexible cement.

To use the liquid juice (the only means by which success had been before in any degree approached), confines the manufacture to the tropical countries producing it: the employment of solid caoutchouc allows it to be prosecuted without restriction of place. When it was attempted to use solid rubber, the surface was left adhesive and viscid, and therefore excessively inconvenient to use, and liable to continual injury. By Mr. Macintosh's process it is left hard, dry, and elastic. In all former plans the caoutchouc was the outer surface, and would soon be destroyed, and along with it the peculiar usefulness of the whole texture: in the present it is the inner and protected part of the compound fabric; which fabric is thus rendered waterproof as long as its threads last. Former plans were far too expensive for common use: this renders these highly useful fabrics articles of popular convenience and demand. It should here be remarked, too, that the coal-oil used is an article either never known, or at least produced in very limited quantities at the time of the earlier trials.

About the time that this great improvement was introduced, Mr. Hancock succeeded in obtaining from abroad a small quantity of the liquid caoutchouc as it exudes from the tree, the first ever imported into this country, and preceded in Europe, it appears, only by the specimen analysed by M. Fourcroy. Its chemical constitution was examined by Dr. Faraday, whose observations (with which are incorporated those of Mr. Hancock) form a highly interesting paper in the 41st number of the "Journal of Science." Before we proceed to other parts of this production, it is right to notice that Dr. Faraday attributes "the extensive uses, both domestic and scientific, to which Mr. Hancock has applied common caoutchouc to his (Mr. Hancock's) peculiar mode of liquifying it." The Doctor proceeds:—

"The fluid, I understood, had been ob*tained from the* southern part of Mexico, and *was very nearly in* the state in which it came *from the tree; it* had been altered simply by the formation of a slight film of solid caoutchouc on the surface of the cork which closed the bottle. The caoutchouc thus removed was not a 500th part of the whole. The fluid was a pale yellow, thick, creamy-looking substance, of uniform consistency. It had a disagreeable ascescent odour, something resembling that of putrescent milk; its specific gravity was 1011·74. When exposed to the air in thin films it soon dried, losing weight, and leaving caoutchouc of the usual appearance and colour, and very tough and elastic: 202·4 grains of the liquid dried in a Wedgewood basin, at 100^{0} Fahr., became, in a few days, 94·4 grains; and the solid piece formed being then removed from the capsule, and exposed on all sides to the air until quite dry, became 91 grains: hence 100 parts of sap left nearly 45 of solid matter.

"Heat caused immediate coagulation of the sap, the caoutchouc separating in the solid form, and leaving an aqueous solution of the other substances existing with it in its first state."

Those of our readers who wish to be accurately informed of its chemical composition and properties, should by all means consult this paper. The following extracts must suffice for the present:—

"When the diluted sap was suffered to remain at rest, a separation soon took place, similar to that which occurred with the native juice, but to a greater extent; a creamy portion rose to the top, whilst a clear aqueous solution remained beneath. Hence it was found easy to wash the caoutchouc, and remove from it other principles which had been generally involved it it to a greater or smaller extent during its coagulation. For this purpose a portion of the sap was mixed with about four volumes of water, and the mixture put into a funnel, stopped below by a cork; in the course of eighteen or twenty-four hours, when the caoutchouc had risen to the top, and occupied about its original volume, the aperture at the bottom of the funnel was opened, and the solution drawn off; more water was then added to, and mixed with, the caoutchouc, and the operation repeated, and this was done four or five times, until the water came away nearly pure. During the latter washings, the caoutchouc required a longer time to rise to the surface, in consequence of the decreasing specific gravity of the solution in which it was suspended. This was obviated at times, according to the experiments for which the caoutchouc was required, by performing the first washings with solutions of common salt, muriatic acid, &c., and ultimately finishing with pure water.

"In this way the caoutchouc was purified, without any alteration of its original state. It now appeared in its state of mixture with water, perfectly white: portions of it left for a twelvemonth over water, underwent no change in that time, except coagulation and a slight film upon the surface; the rest was as miscible with the water as at first, and, when coagulated, equally elastic. The sap, or the washed caoutchouc, is much more easily preserved in the diluted than in the concentrated state.

"It produced no particular appearance with the solutions of iron, or other metals.

"When evaporated, either on paper, or in a capsule, or otherwise, the caoutchouc was left in its elastic state, and perfectly unaltered, except with respect to purity. When put on to absorbent surfaces, as bibulous paper, chalk, or plaster of Paris, the water was rapidly abstracted, and the caoutchouc almost immediately united into a mass, retaining the form of the thing on which it was cast. In this way Mr. Hancock has made beautiful medallions with the sap. Poured on to a filter, the water passes through, and the caoutchouc coagulates.

"When aggregated in any of these ways, the caoutchouc appears at first as a soft white solid, almost like curd, which by pressure exudes much water, contracts, becomes more compact, has acquired elasticity, but is still soft, white, and opaque. It also attains this state, without pressure, if time pe permitted for the water to evaporate. The opacity belonging to it is not an essential property of the body, but due to water enclosed within its mass; further exposure to air allows of the gradual dissipation of this water, and then the caoutchouc appears in its pure and dry state, as a perfectly transparent, colourless, and elastic body, except it be in thick masses, when a trace of colour is perceived. The change from first to last is best seen by pouring enough of the pure mixture into a Wedgewood or glass basin, to form ultimately a plate of $\frac{1}{16}$ or $\frac{1}{12}$ of an inch in thickness, and leaving it exposed to air at common temperatures undisturbed.

"No appearance of texture can be observed in the pure transparent caoutchouc; it resembles exactly a piece of clear strong jelly. All the phenomena dependant upon its elasticity, which are known to belong to common caoutchouc, are well exhibited by it. When very much extended, it assumes a beautiful pearly, or fibrous appearance, probably belonging to the effects which Dr. Brewster has observed elastic bodies to produce, when in a state of tension, upon light. When it has been extended and doubled several times, until further extension in the same direction is difficult, it is found to possess *very great strength. Its specific gravity is 0·925, and no reduplication* and pressure of it in a Bramah's press was found permanently to alter it. It is evidently pervious to water in a slight degree, or otherwise the interior of a piece of caoutchouc coagulated from the sap would always remain opaque. It is equally evident that water passes but very slowly, from the time it takes to evaporate that which lies in the middle of a thin cake. It is a non-conductor of electricity."

It appears that a great improvement in the making and applying of thin strata was one of the consequences of Dr. Faraday's Memoir.

Mr. Hancock seems to be the only person who has succeeded in procuring the liquid juice: his success appears to have induced him to take out a patent in 1825 for a kind of artificial leather, formed by mixing fibrous materials with it, for purposes where great extensibility would be inconvenient, but where flexible vessels or coverings, capable of resisting the action of acids, are needed; there can be little doubt that this composition may be used with great advantage. In the next year he took out another patent for a composition intended to answer a similar purpose, but more cheaply, and without dependence on the supply of liquid juice. In this, solid caoutchouc properly dissolved is the principal ingredient, consistency and stiffness being given by cheaper and coarser materials. In 1830 he also patented the application of his fabrics to certain articles of dress.

For ten years Messrs. Macintosh and Hancock were left to themselves in this manufacture; for few were daring enough to undertake the adapting of so singular and unmanageable a material to the wants of domestic life, and the overcoming of the prejudices opposed to its introduction, however they might wish to share in the profits when the toil was over. At length, a few improvements were made in Germany, then in Paris, and were afterwards adopted by Messrs. Hancock and others in London. Messrs. Wood and Westhead, of Manchester, and Mr. Sevier, have patented amended processes, or new adaptations, and the latter gentleman has extended the use of the material to new purposes. A method has also been discovered, of obtaining from it, by destructive distillation, an essential oil likely to be highly useful in the arts.

The last patent which has been obtained, is again by Mr. Hancock, in conjunction with Messrs. Macintosh. It is for an improvement in air-tight cushions and beds. Few of our readers need be told that these articles have been of the impervious double texture to a great extent. They have afforded relief to invalids, by whom they have been generally used; and much has been done to increase their utility in particular cases, by making them, in each case, of a shape fitted to relieve the peculiar infirmity. Still, however, they had one fault—a fault, by the way, common to all air-tight beds or cushions, of whatever material—when pressed with the weight of the body, they felt comparatively hard and solid; and this feeling of solidity increased with the time that the patient remained on them. This arises from the circumstance, that the enclosed air resists compression with greater force than is consistent with the ease of the patient; and the covering or bag (as the double texture is popularly called) of Macintosh, is too inextensible to allow relief by the only other mode—a change of its capacity. To remedy this serious defect, the cover or bag is gathered into deep creases, folds, or puckers, by thin straps of caoutchouc attached to its inner surface in the process of making: the cover itself is thus made elastic, and adapts itself not only by change of shape, but by change of capacity, to any partial pressure: a feeling of ease and softness is thus imparted to it which the invalid well knows how to prize. Dr. Arnott's beautiful contrivance, the hydrostatic bed, does much, and in a similar way, to alleviate the sufferings of protracted disease; but, on many occasions, it may be found inconvenient or inapplicable, and departs, perhaps, too widely from common domestic usage, to be employed extensively in private houses. Mr. Hancock's adds another to the existing means of relief, and that of a kind which readily falls in with old habits and arrangements. It is said that to invalids the improved beds have been found invaluable.

In a late number we noticed the application of caoutchouc to Mr. Cow's boats. We understand that some gentleman in the neighbourhood of Liver*pool strenuously urges* the use of life*boats of this material.*

It is found to be a much better material than leather for the hose used in breweries, distilleries, &c. We have heard, that, in the brewery of Messrs. Barclay and Co., not less than 2,000 feet of it, of a large size, have been used for some time. For attaching tenders to locomotive engines, it succeeds well; the heat in this case being too great for any other flexible material.

Diving dresses are now fabricated of Indian-rubber cloth: such were used in the late submarine explorations; the long flexible tubes by which air is supplied to the diver are made of linen, saturated with caoutchouc varnish, and covered and lined with sheet rubber. Shoes and galoshes are made in great quantities of the last-named article; many shoemakers having become exceedingly expert in the management of it, and producing shoes of every variety of strength and fashion: from such as are capable of bearing the rough usage of the sportsman to those fitted for the lady's promenade.

The history of the caoutchouc manufacture leaves no doubt as to where the credit of rendering this singular and valuable substance available to personal and domestic comfort ought to remain; and, if public legal justice could always follow the line of actual justice, there can be as little doubt that the pending trial would confirm the legal rights of Messrs. Macintosh and Hancock. It is not for us to guess by what shuffle of law, or quirk of dexterity, substantial justice may be defeated, if it be defeated; but we shall watch the proceedings with interest, for we look for much curious information, as well as for singular illustrations of the present miserable state of the law of patents.

TAIT'S AND HUTCHISON'S GASOMETERS.

Sir,—Mr. Hutchison or Mr. "Clovis," or by whatever other name this "*ingenious engineer*" chooses to go by, may write on, and writhe and flounder, like a newly-harpooned whale, but I can assure him, that, should he write till doomsday, he can never succeed in persuading any man, of the most moderate understanding, that the gasometer he has taken out a patent for, is not a literal copy, in all its essential parts, of my "*Improved Gasometer*," as publicly described, June, 1824. If Hutchison, in fact, had not been perfectly conscious of this, why did he, after giving notice of action last autumn, to the City of London Gas Company, in Dorset-street, respecting two gasometers, which they had just erected on the same plan, *decline going into Court?* The reason is abundantly obvious. He knew, to a certainty, that his pretensions would have been scouted in any court of law in the kingdom.

I have openly advanced my claim to the invention of this gasometer; and I have substantiated my claim *by clear and distinct evidence.* What, on the contrary, has "*the* PATENTEE (!) done?" He has met my demand, and the proofs of it, *by a vague and malicious calumny*, having no foundation whatever in truth, and for which we have only his *bare* (and not very impartial) *assertion*, unsupported by the slightest tittle of evidence, even as to *time, circumstance*, or *place.* Is *this* a way to support a patent right? I allude particularly to the following paragraph, which, is, in fact, the burthen of his song throughout all the other paragraphs of his letter, dressed up in all variety of shapes. "I know also" (he says) "that, though he" (Tait) "succeeded in getting a trial made, he suffered the pain of witnessing its complete failure."

Now, if he chooses, I will give him an opportunity of adducing his authority for this, as I have no other alternative left me, under the circumstances of the case, than to tell him—which I do most distinctly—that it is a wilful and deliberate misrepresentation! There is not even the *shadow of truth* in the above most impudent assertion.

Such base and totally-unfounded aspersions on my character as a professional man, are not to be tolerated with impunity; and I must say that a little more deference and respect would not have been unbecoming on his part towards a man whose inventions he had found it convenient not only to copy, but also to take out *a patent for!*

He is a little more specific, however, in the following paragraph:—"I see, by a document now before me (he says), in Mr. Tait's hand-writing, that HIS gasometer *had been tried* at Leeds, *previous to his public* announcement in June, 1824." He then goes on to argue that, "as no apparatus of this description is now employed there, corroborative proofs are therefore afforded, *not only of* TAIT'S GASOMETER *being discarded, but that four years ago Stephen Hutchison's invention was unknown.*" We shall waive the grammar and the *logic* here, and deal only with the *spirit* of this paragraph; which, to do it justice, *is* circumstantial. I have him then tangibly at last.

In June, 1824, as I stated in my former letter, an account of my improved gasometer was published. About four or five months afterwards, in my way through Leeds, I called, as is usual with us, to look at the gas-works. On seeing Mr. Hurst, the engineer, he asked me if I was the person who had published an account of a *telescope gasometer;* and being answered in the affirmative, told me that he had one in the yard, which had been at work *for some years.* He showed it to me; and very honestly pointed out its defect, in regard to its inadequate pressure, *at an early hour.* The fact was, that, although his gasometer was, in every other respect, similar to my own, it differed in one very material point. It was suspended *from the centre*, by means of a bridge, *in the old way.* Mr. Hurst had never published any account of his gasometer; and it was, therefore, by no means surprising that I had never heard of it before. After having seen it, however, I made it a point of honour, while recommending my own gasometer, to mention at the same time that which had been previously erected by Mr. Hurst at Leeds. The "*document*" referred to, therefore, may very possibly be some such communication from me. I have no opportunity of knowing whether Mr. Hurst's gasometer is still working at Leeds or not. I can only say, that it had been at work for some years when I saw it, and had no other fault than what I have just mentioned, which, by suspending it, after my method (as Hutchison has very properly done), would have been easily remedied. But the *hydraulic joint* of Hurst's gasometer was perfect in every respect: so that Mr. Hutchison has, unfortunately for him, no *loop-hole* to get out at there. It was constructed, as any man of common sense would have constructed it, who was not constrained (by a contrivance, in order to curtail the columns,) to have the uppermost gasometer the largest. By referring to the paragraph which I have just quoted, it will be seen that he states the gasometer at Leeds to have been MY gasometer. From the "document before him, in my hand-writing," however, he knew, as well as I did, that the gasometer at Leeds was *not* mine, but *Hurst's!*

W. TAIT.

THE NEW SAFETY CAB.

We extract the following clear and sensible exposition of the advantages of this new vehicle (the invention of Mr. Hansom, the architect of the Birmingham Town-hall, confessedly one of the finest architectural productions of modern times), from the prospectus of a company which has been formed for promoting its introduction into the metropolis :—

"The very peculiar construction of this carriage secures advantages that men of science and of practical experience have long wished for, but which have never before been obtained. Instead of an axle going through from side to side of the carriage, Mr. Hansom uses a framework, so contrived, that, while fully able to sustain any shock to which it may be exposed, and admitting the use of wheels of any diameter, it allows the body to be placed at any distance, however small, from the ground. By this contrivance, three most important objects are attained: namely—

"1st. *Absolute safety:* for the body is placed so low, and the framework so arranged, as to render it impossible that the carriage should be upset in any direction whatever; nor can a kicking, a rearing, or a stumbling horse place the passengers in danger.

"2d. *Great relief to the horse in peculiar situations:* for the centre of gravity of the load being placed below the centre of the wheels, the injurious pressure on the horse, in ascending and descending hills with a 2-wheel carriage of the common construction, is avoided; for in descending, the pressure on his back is entirely removed; while in ascending, a small and advantageous addition is made to it.

"3d. *Considerable reduction of draught in all circumstances:* for wheels of larger diameter than usual may be employed, not only without prejudice to the other advantages of the invention, but in promotion of them; and it is on all hands agreed, that very great saving of draught might be effected by the use of large wheels, but for the hitherto supposed impossibility of reconciling them with the other necessary properties and conveniences of a carriage.

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"The inconvenience and danger of the present cabs have been long, loudly, and justly complained of. The new cab is perfectly and obviously safe, and effectually protects passengers from injury by a vicious or stumbling horse; it affords ingress and egress as safe and easy as those of a sedan-chair, and is smoother of motion than many of the best carriages of other kinds; it also combines the shelter and comfort of a close carriage, with the lightness of an open one, and the speed of the best of the present cabs, at the cost of perhaps one-third less labour to the horse, and with the entire avoidance of the injurious effect of common 2-wheel carriages on hilly roads.

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"In ascents and descents, any moderate degree of safety to the passenger, or of pressure on the horse, has been, hitherto, attainable only by the use of four wheels. Where four are used, they cannot be large: much power is thus lost—to say nothing of the additional friction—and two horses are needed. Absolute safety, and greater comfort to the passengers, and much greater ease to the animal, are now secured by two wheels, and those large ones. The additional horse is thus dispensed with, and posting may be done by one horse, on terms and with a convenience and rapidity yet unaccomplished. The conveyance of mails and dispatches may be done by 2-horse carriages, with the like, or even greater, benefit.

"A carriage has recently been built, and is ready for public inspection and trial, which exemplifies the plan, and fully justifies the preceding observations. It has been subjected to severe trials, both intentionally and by accident; and, by coming out of them without the slightest failure, has proved that its framework may be safely relied on in any emergency."

GAS LIGHTING PROJECTS.

Mr. Matthews, the author of the "History of Gas Lighting," and "Compendium of the Principles and Practice of Gas Lighting," two works of which we have repeatedly had occasion to speak in terms of high commendation, has lately put forth a pamphlet under the above title,* which though the "projects" of which it treats are rather of the "parish" class, contains not a few of much general importance. We regard Mr. Matthews as a first-rate authority in all gas matters, not only because of long and familiar acquaintance with them, but because of the perfect honesty of purpose which characterizes every thing that issues from his pen. In a prefatory introduction to his present pamphlet, he states, that "he never possessed the slightest pecuniary interest in any gas establishment, and that his strictures have been directed by public considerations alone." Although not sorry to see such a declaration, we must say for ourselves that it was quite unnecessary. Nothing but public considerations alone could have dictated the broad, liberal, and in our humble judgment, most just view of the claims of the existing Gas Companies, which is presented by the following extracts :—

"Enormous was the cost to the early companies of erecting buildings, constructing apparatus, and burying pipes in the streets, for the purpose of diffusing over this vast metropolis the brilliant but economical light of gas. Nearly all the really valuable improvements in its operations have been effected at their expense; and from the commencement of their career, have not they lighted the public streets either at a positive loss, or for little or no profit? Though in this instance, as well as in various others, conferring an important and extensive benefit upon the community, has the remuneration for the capital and exertions ever much exceeded the common interest of money? Often it has not even amounted to that, and yet they have been furiously assailed and unjustly defamed, as selfish and infamous monopolists, who exacted unreasonable prices to acquire extravagant profit. But may it not be truly affirmed, that they have generally supplied the public both *well* and *cheaply* too, if *purity of quality*, and *abundance in quantity*, compared with the price charged, be deemed a proper criterion of *cheapness?*

"Notwithstanding the boastful, but delusive tales relating to the *profitable* nature of gas establishments, numerous are the instances of their being carried on for several successive years, without producing any profit whatever! The small dividends with the consequent depreciation in the value of the respective shares, show, that the majority of such concerns have not been profitable; and in various instances, this has actually been the result, where they enjoyed the advantages of the most economical management, as well as every improvement suggested by science and ingenuity to ameliorate their processes. But to persons who contemplate temporary objects only, it may be a matter of indifference if all the gas-lights, which are so generally beneficial, should be eventually extinguished, from the impossibility of continuing to light them at a serious loss: *and this is a consequence, which recent events render probable at no distant period.*

"But one or two striking facts deserve, and indeed demand very serious consideration. In the Act of Parliament for incorporating the Chartered Gas-Light Company (the first established), there was a clause which stipulated that 'upon due and reasonable application made to them for that purpose, on behalf of any parish or parishes within the cities of London and Westminster, &c., they shall undertake to furnish, and shall furnish such parish or parishes respectively with a sufficient supply of inflammable air, for the purpose of lighting the said parish or parishes, or part or parts thereof, with *a stronger* and *a better* light, and at *a cheaper* and *lower* price, *all expenses included,* than such parish or parishes, or part or parts of parishes, could be supplied with, if lighted in the usual manner, &c.' Another clause enacted, that 'every contract or agreement entered into by any parish or parishes shall be null and void, if at any time the price charged for inflammable air, used in lighting the said parish, shall be greater than what at any time shall be paid for lighting any parish or place situate within the cities of London or Westminster, or Southwark, *with oil* in the usual manner.'* This obligation was enforced in a subsequent clause, which enacted that 'if they admit, neglect, or refuse to carry into effect, and fulfil the provisions, &c., it shall be lawful for his Majesty to revoke and make void the said corporation, and deprive them of all their privileges.'

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* *8vo. pp. 16, Simpkin, Marshall, and Co.*

"Such were the conditions imposed by Parliament upon this company, which they not only fulfilled, but actually supplied so plentiful a quantity of gas to the street lamps, as afforded more than *twelve times* the light, which they usually gave, *before gas was introduced!* If this establishment had given only *a little more light* than what had commonly been yielded by oil, they would have strictly complied with the above enactments, but their conduct was characterized by more honourable feeling. To their liberality, at that period, the public are indebted for such splendid lights as now illuminate the principal streets; and having so effectively contributed to the improvement of this important branch of local service and convenience, surely entitles them to some share of regard and admiration, especially from those who enjoy the benefits resulting from their costly and meritorious exertions.

* * * *

"When science and art have combined their powers to improve and extend the benefits of one of the most important inventions of modern times, and to diffuse its advantages over almost every part of this mighty empire, converting 'pitchy night' into a luminous resemblance of day,—the reflection is humiliating, that the first symptoms of its decline should be exhibited in the metropolis,—the great emporium of British opulence and grandeur. But the fact is equally striking and lamentable, that the greater portion of those who commonly burn gas for their purposes, know scarcely any thing more of its properties, than its power to yield light when it is inflamed!

"The statement of a few particulars relative to the principles and economy of gas-lighting may be useful, inasmuch as they will enable any person to form a notion of what is essential for its purpose. In the early attempts to employ gas for obtaining light, it was burnt as it was distilled from the coal, and mixed with all the substances that rendered it so offensive as to excite strong prejudices against its use. It corroded the copper pipes conveying it to the burners, discoloured the bright surfaces of metals, and its odour was a serious annoyance. Its *impurities* being also deemed injurious to health, the separation of such noxious properties became indispensable. Various ingenious chemists, therefore, devoted much attention to effect so desirable an object: the result of their experiments proved, that, by first cooling the gas by passing it through a large quantity of cold water, and afterwards forcing it through several vessels containing a mixture of lime and water, which machinery constantly agitated, the processes deprived it of all objectionable properties; so that it had not even one *twenty thousandth part* of any kind of impurity when it was conveyed to the public by the Chartered, City, Imperial, Phœnix, and other works heretofore established.

"As in the distillation of coal, different kinds of inflammable gases are evolved, which vary in their capability to yield light, the circumstance led to the making of many interesting experiments, for the purpose of ascertaining the proportion of luminous power possessed by each, and consequently their comparative value. The general result proved that the luminous quality, or, in other words, the brilliant light yielded by the gas, was in proportion to the quantity of carbon held in solution by the hydrogen, free from any admixture with other gases evolved in extracting it from the coal. If a large portion of the matter, which chemists call *carbon*, be combined with the gas denominated *hydrogen*, the quantity of light is proportionately great, especially when the other gases evolved with it in distilling the coal, are separated from it. The light produced by it in such a pure state is almost perfectly *white*, similar to the flame of an Argand lamp, or that of a fine mould candle immediately after being snuffed. This furnishes one certain criterion for judging of the qualities of gas; but its luminous power may be accurately ascertained by other means, which different philosophers have invented.

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* *Similar conditions are, I believe, enjoined in the Acts for incorporating all the other metropolitan Gas Companies.*

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"The peculiar circumstances attending the rise and progress of such large and expensive undertakings, as the early Gas Establishments for supplying the metropolis, ought to stimulate the public to afford such encouragement and support, as may be necessary to insure their permanence. Their operations have conduced to the private comfort, as well as the general convenience of its great population. To effect objects of great utility, they expended many hundreds of thousand pounds, in buildings, apparatus, and pipes; but the pecuniary advantage to the shareholders was uncertain, and *has never much exceeded the common interest of money*. Concerns of this kind are not only expensive from their magnitude, but the works are useless for any other purpose. Unlike articles of trade, they cannot be removed from one town to another. Besides, it should be recollected, that at the expense of these Companies the most costly experiments have been made, which have materially aided the progress of improvement in gas lighting, and largely contributed to its present state of perfection."

NOTES AND NOTICES.

Foreign Railways.—The *Suabian Mercury* says, that Russia is determined not to be behind the other continental countries in the establishment of iron railroads, the Emperor having already approved of plans for laying such roads from St. Petersburgh to the royal residences of Zarskojecelo and Peterhoff, one six and the other eight leagues from the capital.

Sawing Extraordinary.—The following surprising feat was performed by two men in six successive days, named Daniel Hughes and William Thompson, his mate, employed by Messrs. Paul and Son, timber-merchants, Golden-square. They cut upwards of 3,000 feet, superficial measure, of pine board, the width being nearly two feet. The amount paid them for this was upwards of 6*l*. In order to perform this most extraordinary task they made 248,544 perpendicular motions with a saw and frame weighing 30lb.; they must, therefore, have lifted the immense weight of 7,456,320lb. This is not making any allowance for the strength necessary to draw the saw through the wood, which must require a triplefold amount, so that the quantity of strength required to accomplish the feat would not be less than equal to 22,368,960lb. weight.

A Wheelbarrow with its own Railway—M. Marechal, of Brussels, on Friday last, made a public experiment of a newly-invented wheelbarrow, with an iron railroad attached to the wheel, which at every turn places itself so as to render the motion of the wheelbarrow rapid and easy. A man went with *it to some distance* on the road, out *of the Namur-gate, loaded* with 750 lbs. weight of *stones, and returned into the* town again. The apparatus is very light and simple, and its action, apparently, is not affected by holes, or any inequalities of the ground. We understand that it may be made applicable to carriages with two, and even four wheels.—*Times, Feb.* 17.

Railway Transit. — It would require 12 stage coaches, carrying fifteen passengers each, and 1200 horses to take 180 passengers 240 miles in twenty-four hours, at the rate of ten miles an hour. One locomotive steam-engine will take that number, and go two trips in the same time, consequently, will do the work of 2400 horses! Again, it would require thirty mail coaches (six passengers each), and 3000 horses, to take 180 passengers and mail, 240 miles in twenty-four hours, at the rate of ten miles an hour. One locomotive steam-engine will take that number, and go two trips in the same time, consequently, will do the work of 6000 horses!—*T. M. Hackney.*

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22ND JANUARY, AND 22ND FEBRUARY, 1836, INCLUSIVE.

Moses Poole, gentleman, in consequence of a communication made to him by a certain foreigner residing abroad, for improvements in Jacquard looms. Sealed Feb. 1, 1836; four months to specify.

John Cooper Douglas, of Great Ormond-street, esquire, for certain improvements in making vinegar from various materials, and in making useful articles from the refuse of such materials, and also in apparatus or vessels for applying and conducting heats to liquids to be used in the manufacture of vinegar and other purposes. Feb. 3, 1836.

Lightly Simpson, of Manchester, chemist, for certain improvements in the preparation of certain colours to be used for printing cotton and other fabrics. Feb. 3, 1836.

John George Bodmer, of Bolton-le-Moors, engineer, for certain improvements in machinery for preparing, roving, and spinning cotton and wool. Feb. 3, 1836.

John Hewitt, of Kirchzie, Cornwall, Gent., for a combination of certain materials or matters, which being combined or mixed together, will form a valuable substance or compound, and may be used with or as a substitute for soap. Feb. 4. 1836.

James Brown, of Esk Mills, Pennycuick, for a certain improvement or certain improvements in the making or manufacturing paper. Feb. 4, 1836.

James Kean, of Johnston, Renfrew, machine-maker and engineer, for an improved throstle flyer, or a substitute for an ordinary flyer, employed in spinning cotton, flax, hemp, wool, silk, and other fibrous substances. Feb. 12, 1836.

Franz Moll, of Grove Lane-terrace, Camberwell, esquire, for an invention of improvements in preserving certain vegetable substances from decay. Feb. 18, 1836.

Edmund Ashworth, of Egerton, Lancaster, cotton spinner, and James Greenough, of the same place, overlooker, for certain improvements in the machinery used in preparing and spinning cotton, silk, wool, and other fibrous materials. Feb. 18, 1836.

Julius Jeffreys, of Osnaburgh-street, Regent's Park, Esq., for improvements in curing or relieving disorders of the lungs. Feb. 18, 1836.

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 28TH OF JANUARY AND 25TH OF FEBRUARY, 1836.

John Filmore Kingston, of Islington, Devon, Esq., for a new rotary-engine. Sealed Jan. 28; six months to specify.

William Boulnois, the younger, of Gower-street, Esq., for an improved combination or arrangement of springs for carriages. Jan. 30; six months.

Stephen Reed, of Newcastle-upon-Tyne, gentleman, for a method or invention of two improved hooks, and an improved bow for corves, baskets, buckets, and other vessels, which are conveyed, either loaded or empty, from one level to another by being suspended, and let down or drawn up, more especially for such corves, baskets, buckets, and other vessels, as are used for the purpose of letting down their contents to a lower level, or of raising the same to a higher elevation, in mines, pits, wells, shafts, quarries, collieries, warehouses, factories, buildings, dock-yards, also in and about ships, boats, and vessels, and the tackling thereof, and other works, and in general in all works and cases where cranes, common hooks, and bows, are now used. Feb. 1; two months.

John Baring, of Bishopsgate-street, London, merchant, for certain improvements in machinery or apparatus for combing, or brushing, and separating wool: being a communication from a foreigner residing abroad. Feb. 3; six months.

Frederick Edward Harvey, of the Horsley Iron Works, Tipton, Stafford, mechanical draftsman, and Jeremiah Brown, also of Tipton, roll-turner, for certain improvements in the process and machinery for manufacturing metallic tubes, and also in the process or machinery for forging or rolling metal for other purposes. Feb. 3; six months.

Edmund Ashworth, of Egerton, Lancaster, cotton-spinner, and James Greenough, of the same place, overlooker, for certain improvements in the machinery used in preparing and spinning cotton, silk, wool, and other fibrous materials. Feb. 5; six months.

Henry Adcock, of Stamford-street, Blackfriars-road, civil engineer, for certain improvements in the loading and unloading of ships, brigs, schooners, and other vessels, especially applicable to the unloading of those vessels called colliers, which usually discharge their cargoes in that part of the River Thames called the Pool, near London. Feb. 5; six months.

Alexander Massie, of St. John's, Wapping, engineer, Robert Morton, of the same place, engineer, William Ranwell, of Woolwich, coal-merchant, and Ebenezer Ranwell, of the same place, miller, for certain improvements in the construction of paddles or paddle-wheels for propelling of vessels, which improvements are also applicable to the construction of water-wheels for mills. Feb. 9; six months.

Frederick Herbert Maberly, of Bourne, near Caxton, Cambridge, clerk, for improved machinery for raking, scraping, and sweeping roads or streets. Feb. 10; six months.

Samuel Fenton, of Fishguard, Pembroke, clerk, for an improvement or improvements in the construction of locks and latches for doors, gates, and other useful purposes. Feb. 10; six months.

John Howard Kyan, formerly of Gillingham-street, Pimlico, but now of Ailsa Park Cottage, Twickenham, Esq., for a new mode of preserving certain vegetable substances from decay; to extend only to his Majesty's colonies and plantations. Feb. 11; two months.

Andrew Smith, of Princes-street, St. Martin-in-the-Fields, engineer, for certain improvements in engines for exerting power for driving machinery, and for raising and lowering heavy bodies. Feb. 12; six months.

Charles Schafhault, of Sheffield, gentleman, for an improved steam-generator. Feb. 16; six months.

Joshua Procter Westhead, of Manchester, small-*ware manufacturer*, for an improved method of *cutting caoutchouc* or India rubber, leather, hides, and similar substances, so as to render them applicable to various useful purposes. Feb. 16; six months.

Michael Hodge Simpson, late of Boston, in America, but now residing in Ludgate-hill, merchant, for certain improvements in machinery or apparatus for heckling, or combing, and preparing hemp, flax, tow, and other vegetable fibrous substances, and also waste silk; being a communication from a foreigner residing abroad. Feb. 17; six months.

Joseph Lidel, of Arundel-street, Panton-square, professor of music, for certain improvements in piano-fortes; being a communication from a foreigner residing abroad. Feb. 17; six months.

William Bucknall, of Crutched Friars, cork merchant, for improvements in machinery for propelling vessels and for water-wheels. Feb. 17; six months.

Frederick Chaplin, of Bishop Stortford, tanner, for an improvement in tanning hides and skins of certain descriptions. Feb. 18; six months.

Henry Martinson Robinson, of the Minories, paint and varnish manufacturer, for improvements in certain descriptions of lamps. Feb. 18; six months.

John Barsham, of Stepney Causeway, oxalic acid manufacturer, for improvements in the manufacture of oxalic acids and salacetecella. Feb. 20; six months.

Francois Peyre, junior, of Saint Etienne, France, dyer, now residing at the White Hart Inn, of Southwark, for certain improvements in the means of economising fuel in ships' hearths or cooking apparatus, and of obtaining distilled water from sea-water; which improvements apply to generating steam; being a communication from a foreigner residing abroad. Feb. 23; six months.

Chirton Gray Gilroy, of Argyle-street, New-road, Saint Pancras, engineer, for certain improvements in machinery for weaving plain and figured fabrics. Feb. 25; six months.

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price *6d.* Also, the volume complete, in boards, price *9s. 6d.*

W. E.—We know nothing of the machine alluded to beyond what is stated in the notice extracted from the French papers.

Communications received from Mr. Carter—Emilius—Philo-Herapathius (aut ?)—Sledge-hammer—Dr. Brent—G. Z. M.

Errata.—P. 413, col. 2, line 2 from the bottom, for "exertion" read "erection."

P. 415, col. 1, l. 5, insert after "inconvenient" "agitation."

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USEUM, REGISTER, JOURNAL, AND GAZETTE.

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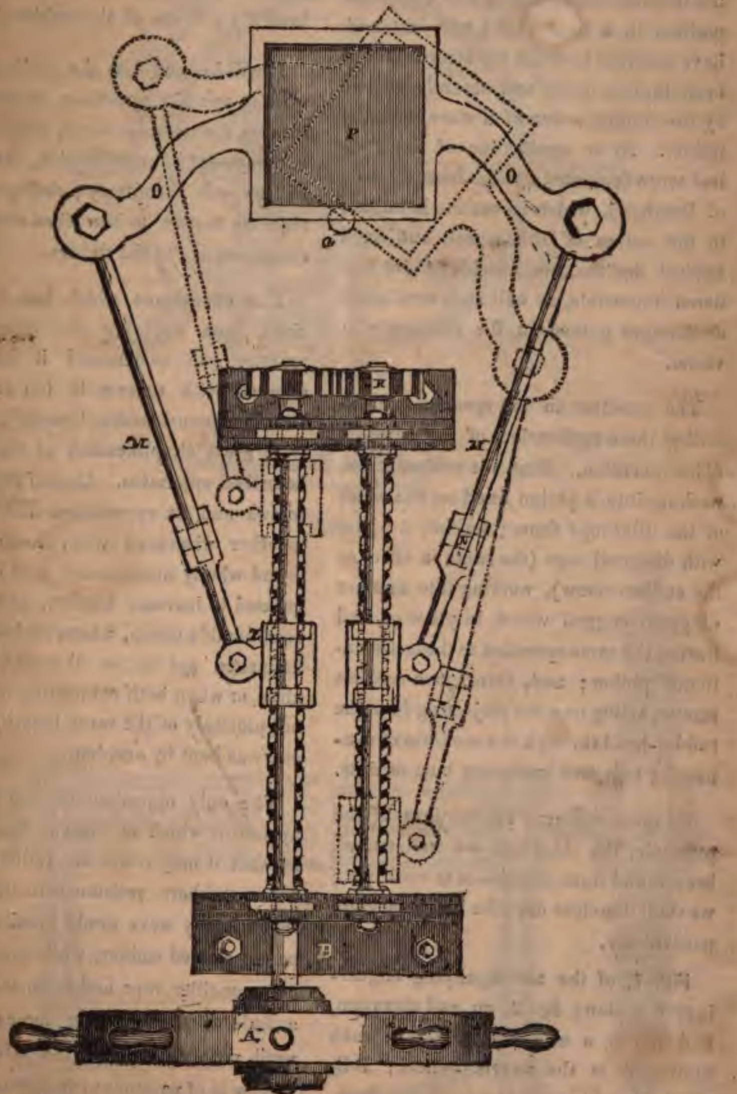
RAPSON'S PATENT STEERING APPARATUS.



RAPSON'S PATENT STEERING APPARATUS.

In working the rudder of a vessel, according to the common method, it has often been found necessary to apply the united strength of two or three men to the steering-wheel to keep it in a required position in a heavy sea; and instances have occurred in which the steersman has been thrown down and severely injured by the sudden action of a wave upon the rudder. By an application of the endless screw (patented by Mr. John Rapson, of Penrhyn), which leaves the helm free to the action of the wheel, but fixed against the sea, such accidents are rendered impossible, as well as several other advantages gained in the steering of a vessel.

The patentee in his specification describes three applications of the principle of his invention. First, the endless screw, working into a pinion fixed on the shaft of the tiller-rope drum; second, a wheel with diagonal cogs (the same in effect as the endless screw), working into another diagonal cogged wheel, in place of, and having the same operation as the last-mentioned pinion; and, third, two endless screws, acting on arms projecting from the rudder-head through the medium of connecting rods and traversing burs or nuts.

Of these different applications of the principle, the third has, we understand, been found from experience to work best; we shall therefore describe it a little more particularly.

Fig. 1, of the accompanying engravings is a plan; fig. 2, an end elevation, and fig. 3, a side elevation. In each figure, A is the steering-wheel; B B, standards; I I, endless screws, one forming the shaft of the steering-wheel, and connected with the other by the pinions K; L L are burs or nuts, traversing on their respective screws; M M, rods, with hinge-joints at N N, to prevent a strain, connecting the burs or nuts with the tiller-arms O, attached to the rudder-head P; *a* is one of the rudder-pins.

It will be seen that the endless screws work in opposite directions, so that, upon turning the steering-wheel, while the first bur traverses in one direction, the second will move in a contrary; thus giving the requisite motion to the tiller-arms, and, consequently, to the rudder.

The experience which has been derived from applying the invention to practice (we understand it has been adopted with success in ten or twelve vessels of considerable tonnage), has led to a great simplification of the before-described apparatus. One of the endless screws and its appendages has been altogether dispensed with, having been found wholly unnecessary, and only calculated to increase friction, and cause a considerable strain, whenever both screws happened not to be threaded exactly alike, or when both connecting rods were not precisely of the same length, or when one was bent by accident.

The only objection to this steering-apparatus which at present occurs to us, is, that it may cause the rudder to give a too stubborn resistance to the sea, so that a heavy wave would break away the patent steered rudder, while one with the common tiller, rope, and drum, would yield a little to the opposing force; and we need not mention that the safety of the rudder is of paramount importance to the ship.

Fig. 2.

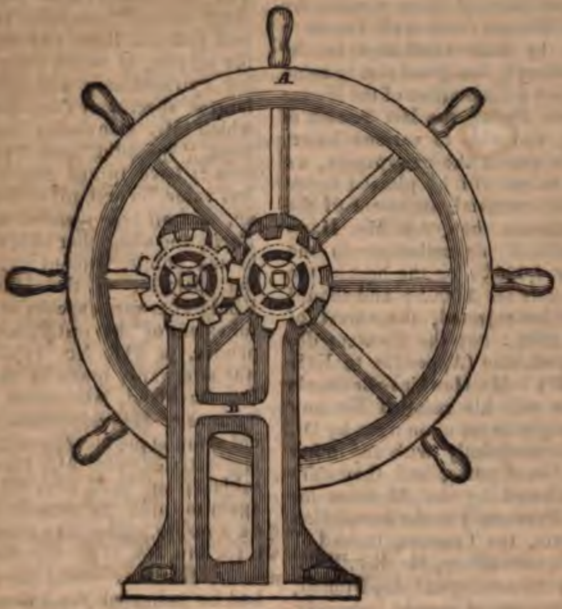
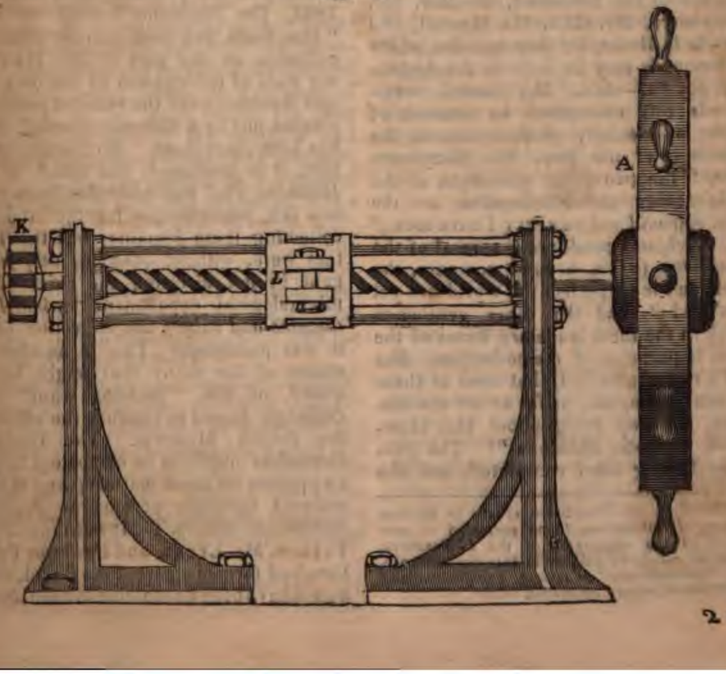


Fig. 3.



MR. HAWKINS'S FOSSIL ORGANIC REMAINS.

As the purchase of these remains by the British Museum (now well known to the public by their exhibition in the Mineral Gallery), has given rise to some inquiry before a Committee of the House of Commons during the last Session of Parliament, and also to various letters and observations in the newspapers, we think our readers will be pleased to see a short, but impartial, statement of the case. It appears, then, that Mr. Hawkins first offered his collection to the Museum for 4,000*l.*; or the best of the Saurian animals for 3,000*l.*; and should these offers be rejected, the rarest of them for 2,000*l.*: but the Trustees declined the purchase (Appendix to Evidence, p. 437). Mr. Hawkins afterwards consented to sell his remains for any price that might be set upon them by Dr. Buckland, or conjointly with any other person he should name, and they were finally purchased by the Museum for 1,310*l.* 5*s.* Previously to the completion of the contract, the Trustees, instead of desiring their own officer, Mr. König, the chief of the mineralogical department, and a most competent person, minutely to examine and value these "Remains," applied to Dr. Buckland, the Rev. Mr. Conybeare, Mr. Clift, Mr. Mantell, and Mr. de la Beche, for their opinion, whose testimonials may be seen in the Appendix, pp. 437—444. Mr. Mantell recommends this collection, on account of "the wonderfullly perfect state of the specimens;" the Rev. Mr. Conybeare says, "the two large specimens of the *Icthyosaurus* and *Plesiosaurus* are the most *splendid* and PERFECT I have seen;" Dr. Buckland considers "several of the specimens to be, beyond compare, the finest and most perfect the world has yet produced;" and the other gentlemen speak in the most laudatory terms of the great importance of the collection. But it is a remarkable fact, that none of these eminent geologists, as far as we can discover, say any thing about Mr. Hawkins's "plaster additions!"* The purchase having been completed, and the collection placed in the Museum, under Mr. König's care, that highly respectable and meritorious officer proceeds, "as in duty bound," carefully to examine it, and makes a Report to the Trustees on the subject, in which there is the following extraordinary passage:—"The two largest specimens (are these the same which Mr. Conybeare considered the most "splendid" and "perfect" he had seen?) have turned out to be of much less value, on account of their being *made up, and all over restored with plaster of Paris*, and altogether unfit to be exhibited to the public, without derogation from the character of the Museum." Mr. König afterwards speaks of the "frightful extent of the restoration" (vide Appendix, p. 441, No. 14). Application was afterwards made by the Trustees to Dr. Buckland, who states that he was "*aware of the restorations*," (why, then, not mention the fact?) and had frequently remonstrated with Mr. Hawkins on the subject; but that, after all, if he were again to value the collection, he should fix a *larger*, rather than a less, price upon it (p. 442, No. 17)! He afterwards says, "Mr. Hawkins would have done well had he indicated the amount of his restorations in his published plates." At a meeting of the Trustees, held March 14, 1835, Dr. Buckland desired to state, "that there had been neither fraud nor collusion on the part of Mr. Hawkins, nor want of information on his own part, and recommended the restored parts to be pointed out by a different colour," which has been since done. No blame, therefore, it is presumed, can attach to *Mr. Hawkins*, who was undoubtedly entitled to a fair remuneration for the labour of collecting these remains; but the Trustees were, without question, very negligent in not directing the chief of the mineralogical department "*minutely to examine and value*" the collection before it was purchased. This is another instance of the many that might be adduced, of the "pressing want" of a *Scientific Board* to conduct the affairs of the British Museum. The Directors *themselves* ought to be competent to give an opinion on these matters; and if such eminent scientific persons as Professor SEDGWICK, Messrs. T. MURCHISON, JOHN TAYLOR, Mr. LYELL, and Professor PHILLIPS, had formed a part of the Board, there would have been no occasion to have sought assistance beyond the walls of the Museum, including, of course, that distinguished geologist and mineralogist, Mr. König, who ought to be present at such a council, not *standing* (Evid. 29, 60), as is now the Gothic custom, before the Trustees, but taking his *seat*, as is usual for witnesses even before Committees of the *House of Commons*, with his other scientific brethren. But our readers must pardon our want of *bienséance* in supposing, for one moment, that it would have been decorous or proper in any mere man of science to have *sat* in the presence of such high and mighty personages as his Grace the Archbishop of Canterbury, the Duke of Rutland, the Duke of Hamilton, the Earl of Harrowby, the Earl Cawdor, the Lord Bishop of London, the Lord Farnborough, the Right Hon. Thomas Grenville, the President of the Royal Academy, Henry Bankes, Esq., and Alexander Baring, Esq., the Trustees *actually present* at the meeting of the 12th of July, 1834, when these illustrious functionaries condescended to "confer" with Mr. König.—Vide Appendix, pp. 394, 395, and p. 438, No. 5.

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* The Rev. Mr. Conybeare speaks of *his own conjectural* restorations being corrected or confirmed, by the appearance of the *Plesiosaurus*, which he considers unique, in this circumstance. *These "restorations," of course, cannot allude to Mr. Hawkins's plaster* additions.

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RAILWAY GRADIENTS.

Sir,—Permit me, through the medium of the *Mechanics' Magazine*, to call the attention of those amongst its readers who are interested in the subject to the necessity which exists of investigating the best mode of laying down the gradients of railways, or, in other words, the best mode of overcoming the summits and crossing the hollows of the earth's surface.

During the last Session of Parliament a considerable time was consumed in the Committee of the Great Western Railway Bill in the House of Lords, in discussing the merits of the two systems, according to which the two opposing lines of railway had been laid down; these lines were the Basing and Bath, and the Great Western Railway.

The former of these had a summit considerably higher than the other, and yet its supporters attempted to show that the mechanical power required to work it was less, because no power was lost on any part of the line; whereas the Great Western had at one place an inclination of 1 in 107, on which considerable power was lost.

The point at issue then resolved itself into this—whether is it more advisable, under every circumstance, to overcome the natural inequalities of the ground surface by sudden inclinations, in order to throw the rest of the lines into planes of very slight inclination; or, on the other hand, to distribute the necesssary rises and falls uniformly, and as equally as possible, throughout all the inclinations on the line.

Widely different and elementary as these two principles are, it will scarcely be believed, that engineers and the scientific world were alike unprepared to afford th Committee on the Bill any satisfactory grounds on which to decide the question. It is not that there were no eminent men called on for their opinion, for on the one side was Dr. Lardner, who contended in favour of the line with the high summit, and which was laid out with gradual inclinations; whilst, on the other hand, the system of concentrating the inclinations, as had been adopted on the Great Western Railway, was supported by a whole host of engineers, amongst whom were Messrs. Brunel, Vignoles, Palmer, Price, and Stephenson.

It is not my intention, at present, to offer any observations upon the two systems; I have only been anxious to direct public attention to the present state of our knowledge on the subject. I shall feel happy if on this hint any of the talented correspondents of the *Mechanics' Magazine* shall think proper to look into the question, and favour the public with the result of their investigations; and, further, it will afford me much gratification to enter into any discussion of which your pages may become the medium.

Your obedient servant,

C. E.

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IMPROVEMENTS IN PADDLE-WHEEL BOARDS.

Sir,—In Brande's *Journal of Science* for the year 1820, there is an account of a very interesting hydraulic experiment, taken from a foreign journal of science, which, if the results stated be accurate, must prove of great practical utility. The experiment was performed to ascertain the force of a jet of water on two discs of equal area; one of these discs had a plane surface, the other had a small rim raised round the edge; the dimensions of the discs are not given, but the fall of water was from 6 to 10 feet. The force of the jet in one experiment on the plane disc was 5lbs., and with the same head of water it was 11lbs. on the disc with the rim; in a second experiment, the results were 7lbs. and 15lbs.; and with a third experiment, 9lbs. and 20lbs.—that is, the disc with the smooth surface opposed a resistance to the jet of water by one-half less than the disc with a raised rim round the edge. If these results should be found to be accurate, it appears to me that a very simple and effective mode of increasing the efficiency of paddle-wheels is pointed out. It would be only necessary to nail slips of wood all round the edge of the paddle-board, and also to divide the surface of the board into a number of small parallelograms by nailing similar slips on its surface. The simplicity of this plan, and the likelihood of its proving effective by impeding the lateral escape of the water from the paddle-boards, is a strong recommendation of its utility, while we continue to make use of paddle-wheels; but I think they must be superseded in time by some better contrivance. This plan cannot increase the back-water in any material degree, as these slips of wood will not be more than one inch thick. Another important advantage in this plan is, that it would allow of a reduction of the size, so as to make the sloped paddle-boards equally as effective as those not sloped, which will reduce the quantity of back-water considerably.

I am, Sir, yours, &c.

X. Y. Z.

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ANNUAL METEORIC SHOWERS.

Our Transatlantic brethren have, for the last two or three years, indulged us with accounts of some most extraordinary meteoric appearances that have taken place in America about the middle of the month of November in each year, and generally on the same day. The phenomenon in question consists of a most brilliant display in the heavens of a great quantity of that class of meteors called *shooting stars*, which, during the whole of the night above alluded to, keep up a constant discharge, and illuminate the whole hemisphere. The most remarkable circumstance, however, attending this affair is, that the phenomenon *always occurs on or about the same day of the month* (namely, the 14th), and that *the direction of* the meteors is generally the same, which has induced many persons to imagine that it is connected with some extraneous body revolving round our globe. Mr. Baily, in the course of his correspondence with Sir John Herschel, noticed these remarkable statements, and requested Sir John to record any extraordinary appearances of this kind that might occur, during his residence at the Cape of Good Hope. The following is an extract from a letter which Mr. Baily has just received from that distinguished philosopher:—"In all my sweeps in November I was on the look-out for shooting stars, viz. on the 10th, 11th, 13th, 14th, and 18th. On the 13th, and especially on the day mentioned in your letter, I told Stone (my assistant) to keep a sharp look-out for them; his attention being disengaged whilst I was occupied at the telescope. He saw none. On the 14th, I still desired him to keep watch for them. The sweep commenced at 0h. sidereal time, and we went on till 4h. 8m. without his or my noticing any. At 4h. 8m. 19s. sidereal time, he called out, 'There goes the largest I ever saw.' It fell in azimuth north about half west perpendicularly. At 4h. 42m. 59s. he cried out again for another great one: this fell north, about two points east, not quite vertical, but rather inclining eastward. This was as large, he said, as Jupiter. At 4h. 46m. 39s. another great one, falling east of Jupiter, and still more obliquely, elicited another call. At 4h. 53m. 59s. I absolutely started from the eye-piece of the telescope, at the glare of a superb one which fell about 20° azimuth west of south, and obliquely. Stone thought that it lightened, though his back was to it, and it was hid from him by trees. It left a narrow, vivid, and distinctly crooked train, which lasted 20 seconds, and admitted of being steadily contemplated. This meteor was equal to Venus, at her brightest *here*: and I ought to mention that Venus *here* casts a strong shadow, in which all the most minute parts of objects, as the leaves of trees, &c. are perfectly well distinguished, not only against the white wall of a house, but on the ground. You may be sure that I shall look out again next 13th and 14th of November, should I still be here; though I can hardly suppose the thing to be more than an accidental coincidence: however, I have seen no considerable meteor since."—*Athenæum.*

HUTCHISON'S DOUBLE-LIFTING GASOMETER.

Sir,—Clovis and Stephen Hutchison are distinct individuals—not one and the same person as Mr. Tait insinuates; I am equally independent of the contending parties, and should enjoy the same pleasure in speaking favourably of Tait's invention, as in describing the value of Hutchison's.

Mr. Tait complains most grievously of the following sentence from my letter of the 4th of February:—"I know also that, though he, Tait, succeeded in getting a trial made, he suffered the pain of witnessing its complete failure." I repeat the assertion, and am prepared to produce my authority.

In the mean time, perhaps Mr. Tait will refer me to the "time and place" when and where his gasometer may have been, or is still to be seen in actual operation. If Mr. Tait will give me "ocular proof" that I have, by wilful and deliberate misrepresentation, cast base and unfounded aspersions upon his character as "a professional man," I will personally (and he shall then see who Clovis is,) grant him that reparation which he would be entitled to. But, at present, I entertain the identical opinions I have hitherto given publicity to.

We are informed by Mr. Tait, that in the autumn of last year S. Hutchison commenced proceedings against the City Gas Company; this circumstance I was not aware of, and I am also equally ignorant of the cause which may have induced Mr. H. to relinquish his intention of bringing his patent before a court of justice. It *may be* in consequence of the reason assigned by Mr. Tait; but whatever determinations Mr. Hutchison has come to in this respect, or in respect to future proceedings, he will not be so indiscreet as to announce them to the world.

The latter part of my letter, published in the 654th Number of your Magazine, contains what I considered a circumstantial and satisfactory illustration of the imperfections of Tait's gasometer, which are so apparent, that an examination would suffice to convince any individual (excepting Mr. Tait himself) of the uselessness of his apparatus; and I appeal to the thousands of scientific men who are in the habit of daily consulting the pages of the *Mechanics' Magazine*, *whether, in the course of* his most intemperate letter, Mr. Tait has refuted any one of the arguments which I have urged against the practicability of his invention? On the contrary, he has contented himself with vague and unconnected generalities, and evaded the specific questions which I called upon him to answer. This evasion amounts to a tacit admission, on the part of Mr. Tait, that his invention is altogether indefensible. All he claims is the priority of idea; and this claim has been admitted.

Mr. Tait concludes his letter by a reference to that document, written by himself, to which I alluded in my reply dated the 4th of February. I have again examined it, and cannot find a single intimation of Hurst's invention. It was evidently written for the purpose of impressing upon the minds of those individuals with whom the writer was in communication, that he *alone* was the original inventor of the telescope-gasometer. The name of Hurst was never mentioned, although that gentleman was, indisputably, the first inventor. Hurst was dead —his body lay mouldering in the grave —and death had closed his lips for ever; therefore Mr. Tait thought he could appropriate the invention to himself with impunity. Keeping these circumstances in view, what shall we say to the following words from his last epistle?—"I *made it a point of honour*, while recommending my own gasometer, to mention at the same time that which had been previously erected by Mr. Hurst, of Leeds." Mr. Tait here, after a lapse of nearly twelve years, takes *Hamlet's* advice, and "assumes a virtue." But would this magnanimous admission of Mr. Hurst's priority have been made, had I not previously informed the world of it in my letter of the 4th of February?

The mode of suspension, which Mr. Tait has taken such infinite credit to himself for having first recommended, had been in use since the year 1807!

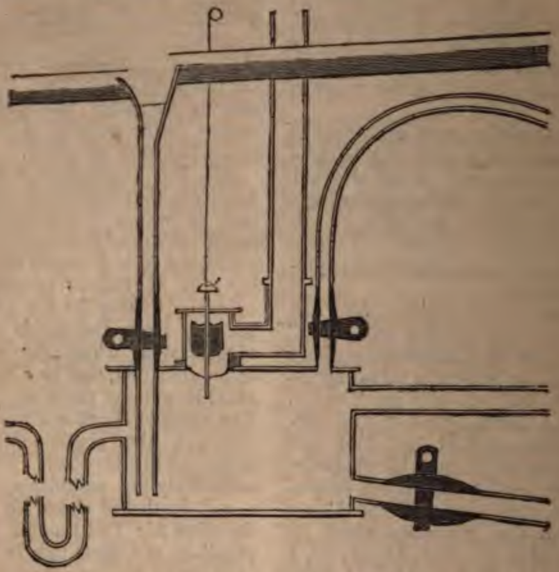
To end the controversy, I call upon Mr. Tait to produce me an exact representation of Hurst's gasometer, with his pretended improvements, so that it may be placed in juxta-position with Hutchison's; the public will then be able to decide upon the subject in dispute.

I am, yours, &c.

CLOVIS.

Feb. 21, 1836.

METHOD OF EMPLOYING THE ESCAPE STEAM OF A STEAM-ENGINE FOR DISTILLING AND OTHER PURPOSES. INVENTED AND PATENTED BY CAPTAIN DAVIS EMBREE, OF NEW RICHMOND, OHIO.



The cut is intended to represent the heater (or, as it is sometimes called, condenser,) of a steam-engine. This is laid down 45 inches in diameter, and 30 inches high. It matters not what shape it has, but its contents ought to be greater than the contents of the cylinder; three or four times as large would be no disadvantage: part of an old steam-boat boiler would make a good one. At the top is an opening of 5 inches diameter—over this there is a cast-iron pipe 8 inches diameter in the clear, and 12 inches high: a valve-seat at the bottom with 4¾ inches opening, and a guide for the stem of the valve of the same casting. At the top of the pipe there is a common cap with a hole and stuffing-box as a guide for the upper end of the valve-stem; an arm and elbow is cast to this pipe, 5 inches in diameter, to which a copper pipe of the same diameter may be attached to carry off the waste steam. The valve ought to weigh about 40 pounds, and be cast with a hollow at the top to receive lead to regulate the weight. The size of *the valve* might be 5½ inches in diameter, *and* 6 or 6½ high. If it be made to *weigh* 45 pounds on a 4¾ inch opening, it will be about 2½ pounds to the inch. The stem of the valve should be wrought-iron; a screw should be cut on the top of the stem; there should be a small bail or handle to screw on it, so as to hook it up, and allow the steam a free passage when not in use. The lower pipe to the right hand, with a cock, is the supply-pipe from the heater to the force-pump 2½ inches diameter, placed within 4 inches of the bottom of the heater; the next above it is the scape-pipe from the cylinder to the heater, 5 inches in diameter. The next (or bent) pipe carries the steam from the heater to the stills; this should be 2½ inches in diameter, with a large cock, affording the same vent. This pipe and cock will not answer with less vent than 2 inches in diameter. The next is an open wooden spout, from the top of the flake-stand to a pipe that descends into the heater; through this, there must be kept a constant stream of water to supply the engine. The pipe into the heater should be of copper, 2 inches in diameter, 87 inches long, descending within two inches of the bottom of the heater, with a cock in it to regulate the supply. At the top of this pipe there should be a kind of funnel, 6 or 8 inches in diameter, in which a strainer ought to be placed; this funnel can have a lip that will let off any surplus water into a wooden spout, to be carried off. The bent-pipe to the left hand is the waste-pipe, to carry off any surplus water that may be let into the heater. This must descend (into the ground, if necessary) 87 inches, and rise again to the same level. It ought to be 2 inches in diameter, and be placed 7 inches from the bottom of the heater.

The principles upon which the machinery herein described operates, are as follow:—

Water, and many other fluids, weigh 8 lbs. per gallon; the gallon contains 231 cubic inches; therefore a vessel containing water, or other fluids of equal weight, to the depth of 58 inches, will be about 2 lbs. to the inch. Hence a valve placed on the heater of an engine, which weighs 2½ lbs. to the inch, will force steam from the body of the heater, through a pipe or tube to the bottom of such vessel and boil it. The quantity wanted can be regulated by a stop-cock, and the remainder will pass off through the valve.

In order to pass water into the heater of an engine under this press of steam, there must be a head raised of greater weight than the valve, say 87 inches high, which will be about 3 lbs. to the inch.

If a surplus of water be let into the heater, it can be carried off by a waste-pipe, which should descend 87 inches, and then rise to the same level: by this means a column of water will be preserved in the pipe, which will prevent the steam from escaping, and, at the same time, let off any surplus water. The shape and size of machinery can be varied at pleasure, taking care to preserve the principles mentioned.

By this operation, there will be a *back lash* or counter pressure on the head of the piston, of, say 2½ lbs. to the inch. Several months' experience, however, at the Richmond steam-mill, has proved, that this is more than over-balanced by the *additional* heat the water acquires in the heater, in consequence of the pressure of the steam. The water is thrown into the boilers of the engine in a *boiling* state. It therefore takes less fuel to drive a mill with *stills, in this* way, than it does to drive the mill without the stills in the usual way. The *power* required is trifling; it is the great body of *heat* contained in the scape-steam, that is brought into use by this invention.

In distilling with this weight of valve, care ought to be taken to have the depth of the beer in stills, and the depth of singlings in the doubler, added together, less than 58 inches. Some inches are frequently added to the depth by the condensation of steam, particularly in boiling cold charges at the commencement of the work. The quantity of beer made use of as a charge, ought to be kept as nearly the same, at every charge, as possible. A tube should be fixed in the vessel used as a heater, at the proper height to hold a charge, with a spout from it into the cistern where the beer-pump stands, to carry back what may be pumped over the requisite quantity. It is also necessary to double at every charge, so as to keep the same *weight* in the stills at all times, or the running will not be regular.

In using the scape-steam, there is a complete system of balancing; the columns of water in the pipes at the heater are slightly kept in motion, swelling and sinking as they outweigh the valve; the valve may be said to float in steam, gently touching its seat, then rising at every new impulse; while the stills pour out a stream of condensed liquor with a *regularity* that can scarcely be surpassed by any thing in nature.

THE ONLY SAFE POSITION OF IRON SAFES.

The following observations on the insecurity of the ordinary iron safes, and on the only effectual method of preserving books and papers, and other valuable property, are from the pen of Mr. Dwight of the *New York Daily Advertiser*—a good authority, since he had the greater part of his property deposited in safes destroyed during the late fire, and saved much property not so deposited by the means mentioned below. They are well worthy of consideration:—

"We thought we would wait a day or two before we mentioned our own case, as things have become more settled and people thinking about rebuilding, we would state that we had apparently one of the finest safes in the world, built full two feet thick of stone, with an outer and inner iron door; in this safe were deposited a large quantity of old papers and books. We felt confident of their security, but after the fire was subdued, although the safe stood entire, the books were so completely consumed, that hardly a handful of dust remained. In the Merchants' Exchange there were some twenty-nine safes similar to ours. As for iron chests we hear the same accounts from all parts of the city; even Mr. Delano, the celebrated maker of these chests, we learn, had all his *iron chests destroyed by the fire*, and has, or will claim, his loss from the insurance offices for the same. There is one mode, however, where books and papers may be saved, and that is by building a safe or depositing an iron chest, in the vault under the side walk (foot pavement). We know of a number of persons who had their books placed in chests in vaults, and have found them all safe. We saved three or four thousand dollars worth of paper and type, in a coal vault, under the street, and millions of property might have been saved by adopting our plan. When the fire was raging and spreading to an appalling extent, and when property which had been twice removed to distant places had been destroyed,—when there appeared to be no limit to the devouring element, nor security for the goods deposited, we resolved to place our goods in the coal vault under the side walk; the project was ridiculed by many persons, who witnessed the men taking in the goods. But although every building in the range was burnt, and the ruins filled the side walks above, yet the property, which consisted of type and paper, articles as easily injured by fire as any other, were found perfectly secure and uninjured. The valuable experience we have induces us in the strongest manner to urge the building of vaults under the side walks, and the placing of safes for books in them. We would also recommend persons who have opium and other valuable goods, to place them in vaults, where we are confident they will be secure from fire."

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THE HOT-WATER HEATING SYSTEM.

Sir,—Observing with regret the numerous accidents occasioned by the common mode of heating conservatories, &c., and having seen the little attention this subject has generally met with, I offer the following remarks on the method now sometimes employed (viz. by the circulation of hot water), hoping they may not be deemed unworthy your valuable pages.

To bear out my succeeding remarks, I must first state the principle on which the action depends. A boiler is placed outside the house, the bottom of which is very little, if any thing, below the floor of the conservatory, and from the top of this proceeds the pipe, which conveys the hot water through the house. Now as this pipe is required to pass near the floor, it must fall to that level before it enters the house; this amounts, in some cases, to $\frac{2}{3}$ the whole fall of the water. Supposing this effected, the pipe then proceeds in a horizontal direction, quite round the inside of the building, to be heated, and then repassing through the wall, completes the descent to the bottom of the boiler. Sometimes, instead of this, the hot water-pipe, as it may be termed, after leaving the boiler, passes, in some cases, horizontally along the middle of the building, and when at the far end falls underneath, about six inches, and then returns also horizontally, passing through the wall and returning, as before, to the bottom of the boiler.

The current is in either case produced by the greater density in the descending or cold water pipe overcoming the pressure of the water in the boiler, which, in fact, constitutes the ascending pipe; this being rendered lighter by the heat imparted. Now the horizontal piping may be considered as merely forming a connexion between the top part of the ascending and descending pipe; the effective length of fall will, therefore, be the perpendicular distance between the highest and lowest point in the current; and the sooner we attain this highest point, and the longer we maintain it, the more the water will cool, and, consequently, the greater will be its density before it reaches the descending pipe. If we therefore place the *top* of the boiler instead of the *bottom* on a level with the conservatory floor, carry the top pipe perpendicularly up about a foot, and then convey it horizontally through the wall and quite round the inside of the building, not permitting any fall until we arrive at the point from which we started; and then repassing the wall, make the descent *at once* to the bottom of the boiler; we shall have the hottest water in the ascending pipe (which was, as I before stated, principally formed by the boiler), and the coldest in the descending pipe; instead of which, by the usual method of proceeding, we obtain a difference of density not more than half what it should be.

I now suggest another alteration, which, I think, is equal in importance to the preceding; I mean with regard to the form of the boiler, which is merely used to keep imparting heat to the ascending current as fast as it is given out in the horizontal piping. Supposing the whole of the water removed, except that portion or column directly between the mouth of the pipe, which leads it into the house, and the one which returns it to the boiler, the current would proceed without any impediment. In fact, I consider the rest of the water as only prejudicial, by absorbing a great part of the heat, and producing in itself a number of currents and counter-currents quite independent of that in the pipes, caused by the radiation of heat and consequent cooling of the water at the top of the boiler. To supply this loss from the boiler, frequently requires one-sixth as much as to maintain the loss by the pipes, and it takes at least seven times as long to raise it to the necessary temperature. Were it not, therefore, for the greater danger of burning the pipes, we might employ a common cast-iron pipe in its place; but as it is, I would recommend a wrought-iron plate rivetted into a cylindrical tube about three times the diameter of the horizontal piping, causing the flue to wind spirally round it from top to bottom.

The waste, I suppose, to be supplied in the usual manner, viz. by a globe placed a little above the highest point in the current; which globe I would recommend to be always provided with a steel-yard valve to keep in the steam which may form, although the water should in no case boil.

Hoping these remarks may not prove useless,

I remain, Mr. Editor,
E. J.

MR. PERKINS'S IMPROVED STEAM-BOILER.

Sir,—In your Magazine of the 13th ult. you have taken notice of the last modification of my steam-boiler. I should have passed over this attack upon me, as I have all others, in silence, had it not been for what you have stated as to a trial of my boiler, which you were pleased to say was made on the Liverpool and Manchester Railway, but *not adopted*.

Now, sir, I will state a fact (which will give you an opportunity of correcting this error), which is, that neither my present boiler, nor any other which bears the least resemblance to it, was ever on the Liverpool and Manchester, or any other railway.

No one can with truth assert, that I have ever had any kind of boiler of my construction on any railway. You have undoubtedly been misinformed by some interested engineer, who most likely knew that I had been on the Liverpool and Manchester Railway attempting to cure some of the defects of their boilers, where, however, I soon saw enough to be satisfied that nothing short of a radical change in their construction would ensure success; and this change, I hope, I have now effected.

You will, doubtless, see the propriety of giving this reply an early insertion in your Journal.

Yours respectfully,

JACOB PERKINS.

London, March 2, 1836.

[We regret the inaccuracy, into which we have been betrayed, respecting Mr. Perkins's boiler; but he has himself, in some measure, to blame for it. We remember well to have seen it stated more than once in the newspapers, that Mr. Perkins's new boiler was on trial on the Liverpool and Manchester Railway, and doing great wonders there; but we never happened to meet with any contradiction of this (as it now appears to be) very "flattering tale," and think we may venture to assert, that none ever appeared. "Silence" under attacks is as often an affair of mere temperament as of lofty sentiment, and under most circumstances, a very questionable virtue; but of "silence" under false praise, there can, we presume, be but one opinion. It is, of course, quite possible that Mr. Perkins himself may not have seen or heard of the statement we allude to; but whether aware of it or not, the fact of such a statement having been long current and uncontradicted, is, so far as we are concerned, an apology—if not justification—sufficient. —ED. M.M.]

THE PATENT CAOUTCHOUC CASE.

Macintosh and Co. v. *Everington and Ellis.*

We have to congratulate not only the plaintiffs, but all who invent, or are interested in inventions, on the successful issue of the action brought by Messrs. Macintosh and Co. in support of their patent, which Messrs. Ellis and Everington had infringed—a very full report of which we now give.

The decided turn which the feelings of Judges, Jurors, and the public have taken in favour of inventors, appears to us not one of the least important of the multitudinous changes of the present day. We will not stop just now to say how it came to pass that a notion should prevail, that those who labour with the intellect (and whose labour, after they have taken their own due share of profit out of it, is of all others the most prolific of benefit to their fellow men), should not be entitled to as effectual and as zealous a protection as those who labour only with the body. A better state of things is evidently approaching: a British jury has again decided, that substantial justice in these matters shall be dispensed in spite of technical objections. The verdict which so righteously secured Messrs. Mackintosh's and Co.'s patent is another and a decisive blow, both at the old monstrous legal theory of patents and at the prevalence of the robber-like maxim, which has too long influenced many in the manufacturing world, "that any patent, whether good or bad, is fair game to him who can either elude or upset it." For our parts, strenuously as on the one hand we shall oppose any law or practice which leaves a patentee at liberty to claim any thing or nothing as his whim or his interest may dictate, without regard to what is his real invention; we shall, on the other, do our best to establish the sentiment, that he who robs another of his invention, and succeeds by legal tricks in establishing the wrong, is no better than a swindler, who may chance to escape conviction through want of evidence. In the present instance, however, justice is not defeated.

We forbear further comment; the offence committed by the defendants has, unfortunately, been too common to allow us to single them out for such censure as the merits of the case itself really call for. But as the most effectual defence of an invention, even under the best laws, will ever be found in a strong and enlightened public opinion, we shall not forbear to point out in future cases the enormity of this most nefarious practice.

COURT OF COMMON PLEAS, GUILDHALL, 25TH FEB., 1836.

Before Lord Chief Justice Tindal, and a Special Jury.

MACINTOSH *v.* EVERINGTON.

Mr. Watson opened the pleadings.

The Attorney-General—My Lord and Gentlemen of the Jury, my friend has very distinctly and lucidly stated the various issues joined on this record. You, gentlemen, have to decide whether Mr. Macintosh's patent for making Macintosh's waterproof cloaks, be valid or invalid.

Gentlemen, you have often heard of these cloaks; the invention is applied to various other articles, but the cloaks have obtained the greatest celebrity. This patent has become almost as well known as Watt and Bolton's patent for making steam-engines, or Arkwright's for making spinning machines.

Gentlemen, this patent was taken out in the year 1823; it was respected until within the last few months: it has lately been infringed by the defendants, Messrs. Ellis and Everington, and one or two others, who are acting in concert with them. I think that it is a strong presumption in favour of its validity, that no one has called it in question for a considerable series of years, and not until it is within less than two years of the period of its expiration.

But, gentlemen, it has now become popular; it is also become very profitable; *therefore* is it invaded, and an attempt made to upset it. After all these years of undisputed validity, is it now to be said that Mr. Macintosh was not the true inventor of the expedient by which he has gained this long wished for object; and that if it be a true invention, that he has not sufficiently specified the nature of the process according to the condition of the patent that was granted.

Gentlemen, the great object of Mr. Macintosh, and of others who preceded him, was to obtain a substance fit for application to flexible fabrics, and yet impervious to air and water. Various attempts were made by others to accomplish that purpose; and it had been partly accomplished. There were cements of differerent descriptions, and different processes were used, but none of them succeeded. Either the cement was not flexible when the oil with which it was originally mixed up was evaporated, or there were other objections that rendered the process useless. Mr. Mackintosh set himself to work to remedy these defects; and he discovered a mode by which the object was effectually gained. He applied a cement made of Indian rubber, which is brought from South America, the native name of which is caoutchouc—I may just as well call it Indian rubber, if you please. The cement is made of dissolved Indian rubber, and consists of that alone. The object was to obtain a solvent of this Indian rubber, which solvent should be evaporated, and which should leave the Indian rubber alone as the cement. He then had a double or a treble fabric; he introduced this cement between the folds of the substance which was to be made impervious to air and water, and put the folds together and pressed them; the oil which was the solvent was evaporated, and nothing remained by way of cement, except the Indian rubber: thus one fold was closely united with the other, and the fabric became wholly impervious both to air and water. It could then be applied to various purposes, such as making flexible air-tight and water-tight vessels and tubes; and above all to cloaks, which are light, flexible, comfortable, and entirely waterproof.

Gentlemen, he took out his patent for this in the year 1823, while carrying on business at Glasgow. He specified his invention in the words that I will now read to you, "I, the said Charles Macintosh, do hereby declare, that my said invention doth consist in a manufacture of two or more pieces of linen, woollen, cotton, silk, leather, or paper, or other the like substances, any or either, or combination of any or either, the same cemented together by means of a flexible cement, the nature of which said manufacture is, that it is impervious to water and air." Now, he goes on to state what this flexible cement is: "And, in further compliance with said proviso, I, the said Charles Macintosh, do hereby describe the process which I have found the best for performing the said manufacture, by the following description thereof, that is to say, I prepare caoutchouc by cutting it into very thin shreds or parings, and then steep it in the substance which is produced in making coal gas, commonly called coal oil."

Now I will ask particular attention to these words, because I understand an objection is to be founded upon them:—"I steep it in the substance which is produced in making coal gas, commonly called coal oil." "The quantity of these ingredients is extremely various, and the relative proportions to be employed must depend on the quality of each; but when the caoutchouc is of the best quality, and the oil pure, from ten to twelve ounces of the former to a wine gallon of the latter, will be found to answer. This infusion I submit *to a gentle* heat, obtained from a water or steam bath, and I employ constant trituration until such time as the ingredients are reduced to a thin pulpy mass, when, to render the whole as homogeneous as possible, I pass it through a very fine wire or silk sieve; and if this part of the process has been duly followed out, the varnish will then be without any granular particles, and will, in appearance, resemble thin transparent honey. Fabrics or substances effectually united by cement, thus prepared, in whatever way the union is effected, become both air and waterproof; but with a view to prevent the cement from appearing upon the surface of the manufactured articles, and to insure at the same time a perfect union of the substances, I, in the first place, distend the substances to be united, and with a brush, or other suitable instrument, lay upon the surface of each an uniform layer or coating of the varnish or cement; and when this coating has, from evaporation of the oil, which is extremely volatile, acquired a clammy, viscous consistency (and this will take place in a shorter or a longer space, in proportion to the heat of the atmosphere and the current of air in which the manufacture is carried on, or to which the coated surfaces may be exposed), I apply the varnished side of both substances to each other, and by means of a calender or rollers, or other suitable means, I powerfully press the fabrics or substances together, whereby they become united, and are rendered a compound fabric or substance; and thereafter I expose this compound fabric or substance in a stove room or other suitable place, to a heat of from 100 to 140 degrees, for the double purpose of maturing the manufacture, and obtaining a further evaporation of the oil, which, while it remains, gives off a disagreeable effluvium. When the substances to be united are of an open texture, or not of a smooth uniform surface, I apply a greater number of coatings of the cement or varnish; and when three or more fabrics or substances are to be united together, I coat with the varnish the substance or substances to be enclosed on both sides, and complete the process as before suggested; further, in some cases, it may be sufficient to apply the layer or coating, or coatings, of the varnish upon one side only of one of the fabrics or substances, applying the other fabric or substance uncoated upon the clammy, viscous surface of that which has received one or more coatings of the varnish, and then complete the process as before suggested." He goes on to disclaim that which was before known, so that all the world might know exactly what it is he claims as his discovery. He says, "Now, whereas, caoutchouc, in a state of solution, and dissolved in manner hereinbefore described, is well known to chemists and others, and not new; therefore I do not claim any right, title, or privilege, in respect of the same; but a manufacture of two or more pieces of linen, woollen, cotton, silk, leather, or paper, or other the like substance, any or either, or any combinations of any or either of the same cemented together by means of flexible cement, in manner hereinbefore described, being, to the best of my knowledge and belief, entirely new, and never before used in these kingdoms, I do hereby declare this to be my specification of the same, and that the said specification doth comply in all respects, fully and without reserve or disguise, with the said proviso in the said in part recited letters patent contained."

Now, gentlemen, by this specification he perspicuously and fully described the process which he uses; he marks out that which was before known, and then he declares that of which he claims the discovery, which is the applying of this flexible cement composed of dissolved caoutchouc in the manner he described, that is, by putting it between the two folds of the fabric, and then pressing them together, so that they should be united by the cement, and thus become, from the properties of that cement, impervious to air and water.

Gentlemen, Mr. Macintosh continued for some time to carry on his business at Glasgow after he obtained this patent. He had considerable difficulties to encounter in introducing it into general use; there were prejudices against it. It was said that while it certainly was impervious to air and water, it stopped perspiration; that it was unfavourable to health, and so on. He had to incur very considerable expense in showing the public what were the advantges of it; at last it became popular; it has been, I may say, almost universally introduced; and just as his patent is about to expire, and not before, has it become very profitable to Mr. Macintosh, the inventor.

The defendants carry on business in this town. Mr. Ellis, soon after the date of the patent, had some negotiation with Mr. Macintosh for entering into business with him; that went off, and now Mr. Ellis, along with Mr. Everington, has made cloaks and other articles precisely according to the specification which I have read to you, that is to say, according to it in substance,—upon the principle on which that specification is founded.

Gentlemen, it became necessary that Mr. Macintosh, and those who are now his partners (he having transferred to them a share in the patent) should vindicate their property, and accordingly they have brought this action. Various pleas have been put upon the record. My learned friend, Mr. Watson, was obliged to make almost as long a speech as it will be my duty to make in stating them to you.

In the first place, it is said that George IV. did not grant that patent. I know not for what object that was put on the record *non concessit.* We have got the Letters Patent of George IV. under the Great Seal of England, which we shall produce. I suppose that will satisfy my friend, Mr. Serjeant Wilde. They first say this is all imaginary; you never had such a patent; it is pure invention of you to say that the King ever granted that patent. Gentlemen, we have got it, and we will produce it. They then say, "We never infringed your patent." I shall prove that distinctly by showing that Messrs. Ellis and Everington—

The Lord Chief Justice.—Is there a plea of not guilty?

The Attorney-General.—Yes, my lord, it is the last plea of all; it escaped me for some time.

The Lord Chief Justice.—I was not aware of that, it is generally put in the front rank.

The Attorney-General.—They say "we are not guilty of the infringement." I shall show that just as clearly as I shall show that George IV. granted the Letters Patent; for I shall show they openly and publicly exposed the articles in their shop. I have got one which was purchased there, which will be produced to you; it was made precisely on the principle of Mr. Macintosh's patent. But the two pleas which I presume are really to be relied on are—first, that before this patent was granted, the process was publicly practised; and secondly, that the specification is not sufficiently set out.

Now, I will say a few words before I sit down, on each of these. The defence is, first, that this invention was not new, and that the same thing had been publicly practised before. Now, that there had been various attempts and experiments on this subject, I do not at all doubt or deny; that is the case with every invention; and if you were to say that a patent is to be invalid because experiments have been made which approached it, which have come even within one step of it; why, then, no patent could possibly be established. But even the most important inventions have only been one step beyond the fruitless experiments that have been before made and were abandoned. Various cements had been made before, but they were not flexible; there were other ingredients introduced, which remained, which injured the result. Something beyond caoutchouc was introduced, or if caoutchouc was used, then it was not used in the manner in which Mr. Macintosh has described in his specification. That all former processes were unlike that which Mr. Macintosh has described, is proved by this fact, that until he had taken out his patent, these waterproof articles were not known, though attempts had been made to produce them. After this patent had been established, and he had taken these means to introduce his invention into the public notice, they acquired the popularity I have described.

The next attempt to be made is to show that this specification is bad; it is said that we claim by this specification every sort of flexible cement. Now that we utterly deny. If you look at the specification, the cement which we claim is caoutchouc dissolved, applied and evaporated as described in the specification. I would here, gentlemen, beg leave to quote the words—I would say the memorable words—of Lord Tenterden in the case of Hullett and Hague:—"*In my opinion* (said his Lordship) *a great deal too much acumen has been employed in criticising specifications; as if it were the object of courts of justice to upset patents instead of supporting them.*"

Now, you are not to apply critical acumen to a patent of this sort; you are to put a fair and candid construction on it; you are to see in what sense the language is used by the person who wrote it—in what sense it would be understood by all men who wish to understand it, and to put a fair meaning on it. I deny that there is the smallest pretence for saying that the claim here is too large, since it is "in manner aforesaid" that the claim is made, and "the manner aforesaid" describes the mode of using the caoutchouc as a flexible cement. But from what has taken place elsewhere, I understand it will be put in front of the battle that we have not properly described the solvent because we have called it coal-oil, and have said that it is produced in making coal-gas.

Now, gentlemen, I will beg you, in considering this specification, to observe, that this is no part of our invention; we do not undertake to decide how the coal-oil is to be manufactured, we state that it *is* coal-oil. Our object is to identify the substance, which was then perfectly well known in chemistry and commerce. We say that it is coal-oil, and that you are to employ as a solvent. The perfect excellence of the coal-oil is this,—that it is of a very volatile nature—that it dissolves caoutchouc—that after it has served this purpose it evaporates, and leaves the caoutchouc exactly as it was before solution—and that it is exceedingly cheap. There are other essential oils that will dissolve the caoutchouc, and may then be evaporated; but they are of a much more expensive nature, while this answers the purpose effectually, and is the most economical that can be employed. Now, gentlemen, the words that we make use of in this specification are these:—"I prepare caoutchouc by cutting it into very thin shreds or parings, and then steep it in the substance which is produced in making coal-gas, commonly called coal-oil." Now I will tell you what the solvent is, it is coal-oil; coal-oil being an article which is perfectly well known in chemistry and commerce. They say that is not produced in the making of coal-gas.

Now, gentlemen, in the first place, that is a mistake. When coal-gas is made, three articles besides gas are produced: ammoniacal liquor, tar, and coal-oil. Coal-oil floats on the surface of the water; it is then in an impure state, but it is actually produced in the manufacture of coal-gas, and it is from a manufactory of coal-gas that this oil was obtained by Mr. Macintosh, as I shall prove; with that coal-oil so obtained he made the solution or varnish which he employed in his manufactory at Glasgow.

We are told, I understand, that instead of this being called coal-oil, it should have been called naptha. To have so called it, would have been a misnomer; naptha is a substance of a different nature; it is obtained from the East, and found floating on the surface of the water; it is quite different from coal-oil; and if it had been said that we had employed naptha as a solvent of the caoutchouc, that alone would have been a sufficient ground for invalidating the patent. The substance that we have employed as a solvent is coal-oil, which is produced in the manufacture of coal-gas.

Gentlemen, I have now stated all the objections that are to be made as to the validity of the patent. I have no doubt there is a very formidable combination for the purpose of upsetting this valuable and profitable patent. I have no doubt that the time that has elapsed since this infringement began, has been most industriously employed in ransacking books and patents, in raking up every thing that has been attempted in the way of gaining the object which this patent has effectually attained.

Gentlemen, I have no doubt that a large body of evidence will be brought forward on the other side, as is always the case when attempts are made to upset a valuable patent; but when you have heard the whole of that evidence, gentlemen, I am fully convinced that you will deem it not sufficient to justify you in invalidating the patent which is our property, and which has now become so valuable to us.

Gentlemen, I will call before you a great number of chemists of the first celebrity, of the greatest skill, and of undoubted honour and integrity; they who will tell you that this was new to them, that they believed it was new at the time the patent was taken out, and that if it had been discovered before, they must have known it. I will call a workman from Mr. Mackintosh's manufactory, who will tell you that they made it exactly according to this specification, not departing from the specification in the slightest degree for several years after the patent was taken out; since then some improvements have taken place in the manner in which the cloth is rolled, but down to the present hour the manufacture has been conducted precisely on the same principle.

Gentlemen, having done that, I shall establish a strong *prima facie* case. From what has taken place elsewhere, I have reason to know the attempts that will be made, and unless something, of which we are not yet aware, shall be brought forward in the course of this trial, I am very confident that the validity of this patent will be established.

(To be continued.)

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NOTES AND NOTICES.

The Gun Manufacture of Birmingham.—The Society of Gun-makers was incorporated in the 13th Charles I. (1638), under the name of the Master, Wardens, and Society of Gun-makers of the City of London, from whose manufactories the Parliamentary forces in the Civil Wars were supplied with fire-arms. But soon after the Restoration, this branch of manufacture naturally found its way to Birmingham. It appears that English manufactured fire-arms were not held in very high estimation in the early part of the reign of William III.; for it is said, that being heard at one of his levees to express much regret that he was obliged to import fire-arms from Holland at much expense and with great difficulty, Sir Richard Newdigate, one of the Members of Parliament for the county of Warwick, being present, opportunely recommended his Birmingham constituents to his Majesty's notice as being fully competent, if duly patronised, to obviate the difficulty complained of. The King immediately despatched Sir Richard Newdigate into Warwickshire with an extensive order, and Birmingham has ever since been as famous for the manufactory of fire-arms as for all other ingenious productions. No adequate provision of fire-arms being made by the English Ordnance Department of the last century, the emergency of 1793 was to an alarming degree unprepared for. Lieutenant-Colonel Miller was employed for a year or two conveying orders to the different gun-manufactories in Germany, to procure arms for the British forces. But the manufacture of fire-arms was subsequently carried to such an extent in England, that from 1805 fo 1815, 3,079,120 gun-barrels and 2,935 787 locks, for the use of Government, were manufactured in Birmingham alone; of which, 1,827,889 were completed as muskets, carbines, &c. The supply was in general 30,000 stand of arms per month, or two in a minute! This number is exclusive of fire-arms manufactured there for the East India Company's service during the same period, to the number, as it has been calculated, of about 1,000,000: and exclusive, also, of trading guns, fowling-pieces, &c. These facts are interesting, not only as regards the manufacturing capabilities of Birmingham, but as showing the amazing power of the British Government in having such a manufactory in the centre of the kingdom, from which supplies of arms can be distributed in all directions, for defence or annoyance, *far exceeding* in amount, as it appears by *official returns, all* the fire-arms manufactured in the chief manufactories of France, from the banks of the Rhine to the foot of the Pyrenees.—*From a very interesting article on Birmingham and its Manufactures, in the last Monthly Supplement of the Penny Magazine.*

Mr. Hall's Steam-Engine Improvements.—The splendid new vessel *Hercules*, intended for the station from Cork to London, and belonging to the St. George Steam Packet Company, arrived at Cork yesterday. She had to encounter, nearly the whole of the voyage, a most tremendous head wind and heavy sea; but she rode through them with such ease as to surprise and delight every one on board, who were unanimously of opinion that a finer sea-going vessel never was launched. The steam-engines, which are upon Mr. Samuel Hall's patent principles, and constructed by Messrs Fawcett and Preston, acted in the most powerful and perfect manner. It need only be stated to engineers and others conversant with steam-engines, that the vacuum was so perfect as to support a column of mercury from 29½ inches to 29⅝ inches, and never lowered during the strongest gusts and the heaviest seas to a less height than from 29⅛ inches to 29¼. This excellent vacuum prevented the engines being pulled up in speed almost to a stand still (as in injection engines), and they went on steadily and uniformly as if defying the power of the storm. The *Hercules* is 155 feet long, 48 feet wide, and, from her great breath of beam, will be one of the stiffest and steadiest steamers afloat, and is capable of carrying over 300 tons of goods. —*Southern Reporter.*

Fall of a Windmill. — Yesterday afternoon, shortly after five o'clock, the inhabitants of Mill-street, Lambeth-walk, were greatly alarmed in consequence of the sails of Mr. Saxby's flower-mill, weighing upwards of five tons, falling with a tremendous crash. A number of houses are very much injured, and the damage is estimated at upwards of 300*l*. The proprietor and three of his men were in the mill at the time of the accident, and a number of persons were passing, but we are happy to state that no one met with the slightest injury. The high wind was the cause of the mischief.—*Times, 2nd March.*—[We hope that when Mr. Saxby proceeds to reconstruct his mill, he will have the good sense to do it on the *horizontal* and not on the *vertical* plan—which last was the sole cause of the alarming accident—which has, for the present, put an entire stop to his business. We say "the *sole* cause"—and considerately; for high as any wind may be, as long as you *can* master that wind, and do not, the fault is not in nature, but in your neglect of the means which art has furnished you of controulling the powers and *freaks* of nature.]

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

The Supplement to the last volume, containing title, index, &c. and portrait of Charles Vignoles, Esq., C. E., is just published, price 6*d*. Also, the volume complete, in boards, price 9*s*. 6*d*.

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DR. URE'S PATENT CORRUGATED SUGAR-PAN OR TEACHE.

Fig. 1.

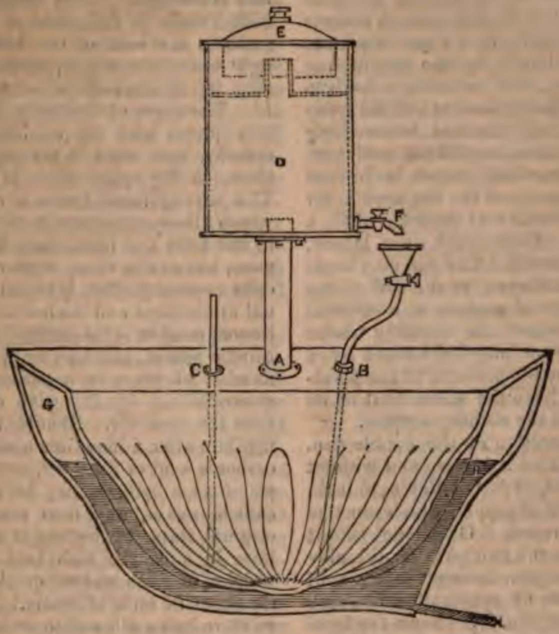


Fig. 2.

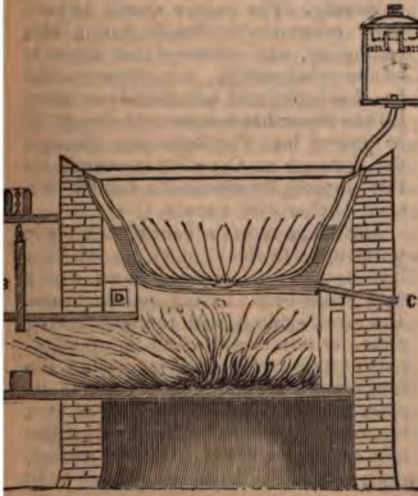
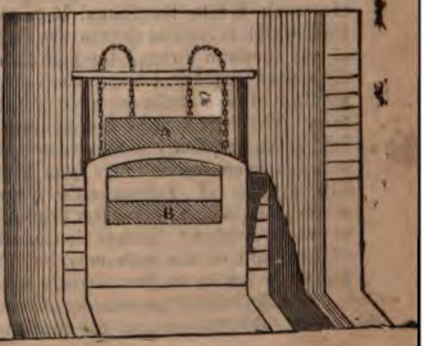


Fig. 3.



DR. URE'S PATENT CORRUGATED SUGAR-PAN OR TEACHE.

The pan is made of cast-iron, and is double. Between the outer case, which is evenly, and the inner one, which is corrugated into a double surface, there is a space for containing a liquid medium, which is unalterable by the fire in any length of time, and serves as a bath to transmit a sufficient heat to boil the syrup very quickly, but intercepts the scorching temperature which turns it into molasses. The sugar, therefore, cannot be burned in the inner pan, and the fire need never be extinguished, as at present, when a skip is struck. Thus, much time, labour, and fuel, are saved. The pan may be set up by any bricklayer, at the end of the ordinary range of coppers in a colonial sugar-house, where the finishing teache now stands; or it may be worked by a separate fire at the pleasure of the planter, and may have the spare heat of its flue applied to the clarifier-coppers.

Fig. 1 is a section of the double pan. Being as tight as a bottle, and without seams or joints, it is not liable to leak, like pans made of copper, which must be rivetted or brazed. G is the vacant space between the two pans for the play of the bath-liquor during the time of skipping, when no evaporation is going on in the inner pan. H shows the level of the bath liquor about two-thirds up the side corrugations. A is a bent pipe, three inches wide, for connecting the space between the pans, with an iron drum D, called the condenser. Any watery vapour which may occasionally exhale from the bath, when overforced by fire, rises freely up the pipe A, and is condensed into water in D. The water thus condensed is quite pure, and is allowed to trickle slowly down through the stop-cock F into the funnel beneath it, from which it runs back into the bottom of the medium through the pipe B, and thus preserves the boiling pitch of the medium always at the requisite temperature. The best heat of the medium for boiling sugar quickly without discolouration has been found to be from 300 to 310 degrees of Fahrenheit's thermometer; but it may vary a few degrees up or down without inconvenience. The temperature of the bath may be made higher or lower, at the pleasure of the boiler. By merely preventing some of the water that exhales into the condenser D from returning into the bottom of the bath, the temperature is raised; and by pouring slowly a little more water into the bath through the pipe B, the temperature is lowered. A few quarts of water added make a difference of several degrees in the heat of the bath. E is a light basin of cast-iron, inverted over the open top of the safety-pipe of the drum D. The edges of the basin rest on three iron props, and dip an inch deep, or thereby, into some water poured round them, in the upper space of the drum. This arrangement forms a water-valve, which allows air or steam to pass freely to and from the bath-space between the pans, but at the same time cuts off the open communication between the external atmosphere and the bath-liquor. This liquor consists of a strong solution of caustic potash, and may be preserved any number of years in a perfect state for sugar-boiling, by this plan of seclusion from the open air. Should the body of medium after a long time absorb so much carbonic acid or fixed air, as to impair its action as a bath, it may be easily made caustic again, and thus restored to its original state, by boiling it for half an hour in a copper with half a hundred weight of fresh-slaked quick-lime, and six times its bulk of water. This lime-mixture being allowed to settle a night in the large copper in which it was boiled, must be ladled off into a smaller copper in successive portions, and boiled down till its boiling pitch rises to 290 degrees, or thereby. The copper should be partially covered with boards during this boiling up, and whenever the liquor is concentrated enough, the copper should be closely covered with boards or mats, till the liquor has become cool enough to be poured into the bath-space through the aperture at C or B (unscrewed for this purpose), by means of a funnel, or a stone pitcher with a spout.

The flange A, of the bent pipe, is made water-tight to the brim of the pan by a lead-washer, and is fixed down firmly with screw-bolts, having square heads. The funnel-pipe B, with the lengthening piece, for introducing water into the bottom of the medium for regulating the temperature of the bath, is fixed in its place by a union-joint screw, turned by a screw-key or wrench. The thermometer tube-case has a flange, with lead-washer, at C, by which it may be screwed tight into its aperture. Into this tube, which is shut at bottom, an inch or two of quicksilver is to be poured, or sufficient for covering the bulb of the thermometer. This quicksilver lying always in the tube, takes the temperature of the medium, and immediately imparts it to the thermometer, on dipping its open end down into the bottom of the quicksilver. The thermometer, after some experience in boiling with the pan, need only be used occasionally, as in the morning and afternoon. It shows at once, whether the bath is too hot or too cool, so that a little water may be poured into it through B in the former case, or a little of the condensed water in D allowed to run to waste, by the stop-cock F, in the second case.

The condensing-drum D must be propped in its proper position, while it is being fixed on to the brim of the pan by the screw-bolts of the flange A. When the pan is briskly at work, both stop-cocks for regulating the medium may be shut, and slightly opened only when the pan is charged afresh with syrup; or the stop-cocks, after a little practice, may both be left always slightly opened, whereby the pan will become self-acting, by the circulation of a little vapour into the condenser, and a return of it in the state of water to the bottom of the bath. Water poured on the *surface* of the dense medium does not incorporate with it, and therefore has little or no effect on its temperature.

Fig. 2 is a section of the patent pan when set as the first of the range. A is the flue leading to the other pans. BB, the shuttle-valve, or dampers, of fire-brick, by means of which the orifice of the flue may be lowered when required; thereby allowing the flame to have less contact with the bottom of the patent pan. C is the medium discharge-pipe, to be made use of only on finishing crop, when the medium ought to be run off into an iron drum, where it would remain free from the influence of the atmosphere till the following season. D D represent the circle of fire-bricks upon which the patent pan is seated.

Fig. 3 represents more clearly the action of the dampers, as previously shown. These are placed betwixt the patent pan and the second of the range. A and B are the two *dampers*, equal in weight, *and consequently of* easy adjustment. When the dampers are furthest apart, the patent pan is receiving the full influence of the fire, but as they approach each other the flame is sucked more rapidly through the diminished orifice, and is in consequence allowed less contact with the bottom of the patent pan.

By these means the fierceness of the fire, as applicable to the patent pan, may be completely controlled, without the least waste of fuel; for while little of the heat is acting upon the patent pan, more is made available to the other pans of the range.

The medium is carefully prepared under the superintendence of the patentee, in a laboratory fitted up on purpose, and is sent out in a state ready for use, in an iron drum-tank, packed in a cask. The orifice of the tank is closed with a screwed iron plug, having a lead-washer under its flange. On taking out this plug with a common screw-wrench, the medium must be poured by portions into a stone or metal pitcher, and thence into the bath-space between the pans; the discharge-hole at the bottom of the pan having been previously closed tightly with its screwed-pipe, and flange with lead-washer. At the other end of this short pipe there is a stop-cock, which is never to be opened but when the bath-liquor is to be drawn off at any vacant period, for the purpose of making it caustic again after some years' use. This stop-cock should in general be incased in brick-work or mortar, to screen it from idle fingers. The bath-liquor is corrosive to skin and wood, and should not be put into wooden vessels or much handled; if a little happens to touch the fingers, it may be washed away with a little water. Should some of the medium be found to be congealed, the bottom of the open tank may be plunged in boiling water for a little, or surrounded with blazing cane-trash, and half a gallon of hot water may be poured in to wash out the remainder.

Should the junction of the outer and inner pans, at their brims above, become in the least open at any time, they may be made secure again, by packing them with iron cement, made of ground iron-borings and sal-ammoniac, well mixed, in the proportion of six pounds of the former to one ounce of the latter, and very slightly damped with water.

When fire is first applied to the pan,

after the proper charge of medium has been introduced into it, the progressive heating of the bath must be carefully observed by means of the thermometer, standing in the quicksilver tube C. If the temperature rises to 290 degrees, or thereby, the pan is ready for receiving its skip of cleaned syrup, which may be boiled in the common coppers of the range to a boiling pitch of 220 degrees without discolouration. A charge of such syrup may be boiled off into good sugar, by the patent teache, in half an hour, and into fine syrup for shipment home in half that time. At the instant of running off the granulating skip into the cooler, the firing should be suspended, and resumed as soon as the fresh charge of syrup is introduced. The pans have a shelving brim, to which the usual sloping saddle of lead or mortar cement may be most conveniently adapted, for allowing the juice to froth up without boiling over. The bath is a constant magazine of heat, by which the hot syrup is made to boil briskly immediately after its introduction, so that not an instant is lost in the operation of a sugar-house. This pan is also more easily managed than the simple teache, as it cannot by possibility burn the juice, the fierceness of the fire merely agitating the bath for a little, without affecting the quality of the sugar. When there is no syrup in the corrugated pan, the medium should not be forced with a strong fire, as having no evaporable liquor to transfer its heat to, it might possibly boil up a little into the condenser. Even in this case, no evil could result, since the moment that the fire becomes moderate, or that fresh syrup is put into the inner pan, the drop of medium which may have been forced up into the condenser D, can be run back into its proper place, through the stop-cock F, and subjacent funnel-pipe.

For some time after beginning to use the pan, it is proper to look every two or three days into the state of the bath, and to measure the depth at which it stands. This is conveniently done, at any interval of the boiling, by unscrewing the quicksilver pipe C, lifting it perpendicularly up, and noting how high the wet mark of the medium is. If it corresponds with about the middle height of the side corrugations, all is right; if it *shows the medium to* stand lower, a few *gallons may be* poured in from the spare tank. Too much medium is not advisable, as it merely heats the sides of the pan above the level of the granulated skip, and as it leaves too little space for the free play of the medium exposed to a fierce and fluctuating fire.

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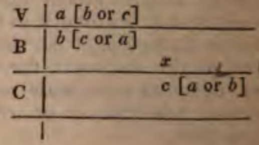
HENSHALL'S CALCULATING-RULE.

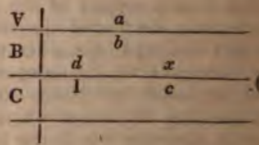
Sir,—I have lately met with a calculating-rule of two slides, bearing the name of J. Henshall, manufactured by Jones, Holborn, which so far as the face of the rule is concerned, is in accordance with the construction recommended by me in the *Mechanics' Magazine*, vol. vii. p. 299. A pamphlet is sold with it, of which the title is given below,* dated 1835; and I was informed that the first rules upon this plan were made about two years previously. The first forty-two pages are occupied with a detail of questions to be worked by the common engineer's rule; the application of the improved rule is shown in about eight pages of the Appendix. The substance of these may be exhibited in the solution of the following equations, expressed in the symbolical language which is not adopted or alluded to in Mr. Henshall's work, although now well known.

$x = a\,b\,c$



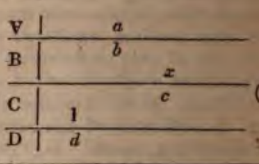
(1

$x = a\,b\,c\,d$



(2

$x = a\,b\,c\,d^2$



(3

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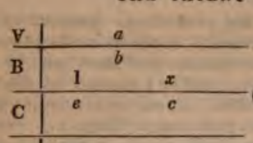
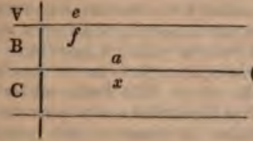
* A Practical Treatise on the Slide-Rule, containing Instructions for applying it to Multiplication, Division, Proportion, Fractions, Use of the Square and Cube Root, Mensuration of Superficies and Solids, Timber Measure, Cask Gauging, Logarithms, Trigonometry, Uniform and Accelerated Motion, Mechanics, Mill-Work, Weight of Bodies, &c. &c.; with an Appendix, containing Instructions for the Improved Double Slide-Rule. Manchester: 1835.

$$x = \frac{abc}{e}$$



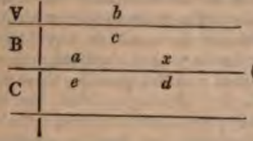
(4

$$x = \frac{a}{ef}$$



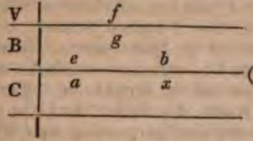
(5

$$x = \frac{abcd}{e}$$



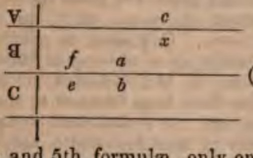
(6

$$x = \frac{ab}{efg}$$



(7

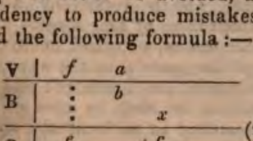
$$x = \frac{abc}{ef}$$



(8

In the 1st and 5th formulæ, only one slide is required to be moved, but where both must be employed, the lower (C) must be moved first. The last formula is identical with what is called Compound Proportion, or the Double Rule of Three; and for the purpose of working it, as directed in the pamphlet, the B slide is to be *reversed*. I would suggest that this step had better be avoided, as having a tendency to produce mistakes. I recommend the following formula:—

$$x = \frac{abc}{ef}$$



(9

The accurate setting of *e* on C, to *f* on A, may be effected by the intervention of the nearest principal division on B, in much less time than would be occupied in reversing that slide.

At the back of the rule is the usual *Table of Divisors.* The pamphlet speaks also of a Table of Multipliers, and of a line of treble radii at the back of slide C, but these are not found on the rules now on sale.

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COURT OF COMMON PLEAS, GUILDHALL, 25TH FEB., 1836.

Before Lord Chief Justice Tindal, and a Special Jury.

MACINTOSH *v.* EVERINGTON.

(Continued from p. 464.)

Mr. Nicholas Wray, examined by Mr. Serjeant Bompas.

I am employed by Mr. Macintosh in his manufactory; I entered his service in 1818; I remember that this patent was taken out by him in 1823; Mr. M. then lived in Glasgow, as I also did; I was among the first that were employed by him in the manufacture; I have seen the specification of the patent; I first saw it about the time of the patent being taken out, that is, shortly afterwards. India-rubber was used, as was also coal oil; tar and ammonical liquor were both received from the gas-works. We got the tar previous to the date of the patent. Mr. Macintosh was using it for other purposes before he used the coal oil for this purpose, but for what I cannot say. He received ammonical water and tar; sometimes the water was mixed with the tar, and the oil was separated from the tar. There were three things: tar, ammoniacal water, and coal oil; we received them sometimes separately and sometimes mixed. The substance we have called coal-oil went usually by that name; coal-oil is not a combination, it is a substance which floats on the top of the tar, and occasionally on that of the water; we skim it off. The India-rubber was cut up into small pieces, and freed from all its impurities. We then put it into the coal-oil, and there left it till cold; and after putting it through a sieve to take away all the other impurities, we applied a little heat to render it more pure and transparent; for which purpose we used a steam bath. We made it exactly according to the specification, or as near as we could come to it. I continued in the manufactory in Glasgow about three years, and then went to Manchester. We made no alteration in the mode of producing this cloth while we remained in Glasgow; we there made it for sale in the way I have described. These are specimens of the cloth we made at Glasgow; made exactly according to the specification. Water will not pass through them, but I cannot speak for air. I proved the cloth with water and air at Glasgow, but I have not the specimens here, which were so proved there. I worked at Manchester nine or ten years; the goods are made and sold there now; there is none now made at Glasgow to my knowledge.

Cross-examined by Mr. Serjeant Wilde.

My department of the work at Glasgow was to prove the cloth. I am not the person who received the article I called coal tar. I did not receive the articles (tar, &c.) from the gas-works; they were not brought to that department which I superintended; I had nothing to do with examining the articles that came from the gas-works, but saw them occasionally in the state in which they came therefrom. The India-rubber came to my care in a state of varnish or solution in a prepared state. I have occasionally assisted in preparing the solution, but it was not my department to do so. I assisted them in all their wants; sometimes in cleansing the rubber, at other times putting it into the oil, and other times in putting it through the sieve. I never assisted in the operation to which the ingredient (whatever it was), which was brought from the gas-works, was subjected, to prepare it for a solution. To the best of my recollection, John Thompson and Robert Sutherland were the men who prepared for solution the article which came from the gas-works. They do not now work in the Manchester manufactory, but I do not know whether they are now in Mr. Macintosh's employ; they were when I left Glasgow. The solution came to me prepared. The first operation was putting it on the surface of one of the fabrics with a brush or spatula; the brush was the general mode, but where there was an uneven part we finished it off with the spatula. We used both; we continued to use the brush at Glasgow as long as I worked there. We could apply the solution so as to render the surface sufficiently smooth and even without using the spatula afterwards. Next, when we found there was a sufficient quantity of solution in the cloth (we always made one texture proof before we applied the other), the second receiving a sufficient coating to make one unite with the other, which uniting was done by passing it through a pair of rollers. The cloth was proved by tapping it with water;—a piece of board was placed under the cloth, a little water put upon the surface, and it was then tapped with the hand; if the water came through it was not proof; that was the only test. We ascertained it was air-tight, by blowing up with air-pillows, or cushions, or beds. Before it is made up we cannot speak to its being air-tight; it is then only to be proved water-tight. After being blown full of air, they were put into a press and allowed to remain there for twenty-four hours; if any of them became slack, then we put them into a cistern of water, which enabled us to discover the defect by air-bubbles rising to the surface of the water over the flaw. The premises in which the solution was prepared were not kept under lock and key. I had access to them at all times, and so had the men generally in Glasgow. I cannot speak exactly to the date of our commencing the manufacture of the cloth; it was about the year 1823; I am sure we began as early as 1824. There were more gas-works than one at that time in Glasgow. We did not apply the cloth to the steam-bath at all, but the cement. The India-rubber we put into the coal-oil; it stood there a certain time before it was dissolved, and then it was put through a sieve to render it more pure. Nothing else was done to it before it was passed through the sieve. The India-rubber came to my department for me to operate upon in a solution or varnish; this solution was not merely the solvent of the India-rubber, but the India-rubber mixed with it. We did not subject the cloth to any other operation, in order to give it a smooth surface, besides this brush and the spatula; there was no occasion for it. Having applied the solution in that way, we passed it through the rollers. There were two men besides myself employed on this water-proof cloth at Glasgow, besides the two I named before. I afterwards removed to Manchester. Charles Macintosh and Co. were the manufacturers there. The business is carried on under the firm of Charles Macintosh and Co. Mr. Macintosh joined partnership with Mr. Hancock; I should think five years ago or thereabouts; about six years after we got to Manchester. Continued to manufacture immediately upon arriving at Manchester. Previous to Mr. Hancock joining, the solution came from Glasgow to Manchester ready for use. We continued to apply that solution at Manchester with the brush and the spatula; but we made a little improvement in machinery, but still with the use of the brush. I am not aware that Mr. Mackintosh carried on any manufacture in Glasgow after we left, except in preparing the solution. At Glasgow we used the brush with the hand, but did not continue to do so at Manchester. There the cement is put on by a roller and spread by a brush. The machine is large enough to take in a piece of cloth two yards wide, and is worked by a steam-engine. About three or four months after we got to Manchester, we ceased to use the hand-brush and the spatula in the way we had done at Glasgow, and I have not used it since. We subject the cloth to more or fewer coatings, according as we want the substance to be made. If it is water-proof, we give it three or more coatings; and if air-proof, four or five, or more. Each successive operation is exactly like that I have already described; whether the cloth is to be water-proof or air-proof, the only difference being in the number; the coatings are all the same. There has been a little alteration in point of preparation of the solution since the conducting of it at Manchester, and a considerable time after Mr. Hancock joined. As near as I can recollect, it was twelve months after that that we began to manufacture the solution at Manchester. We had a stock of it on hand then, which came from Glasgow, which served us for those twelve months; and when that stock was exhausted, we manufactured it at Manchester. Myself and the other men had not access to that part of the manufacture where the solution was manufactured. There is an alteration in the machinery every week in point of improvement. I should think it was more than six months after Mr. Hancock joined, as near as I could guess, that any alteration was made in the machinery. We take the solution out of a large vessel by a can, and put it on the cloth, and the cloth having a motion, it causes the varnish to spread itself across the surface; it then passes under an instrument we call a gauge, which has the effect of spreading it upon the surfaces evenly across the whole width. There is no alteration in the machinery, except the substitution of the gauge for the brush and bar.—[A considerable part of the examination of this witness has been omitted, which related to the process of manufacture as carried on by Macintosh and Co. at Manchester, and which had no relation to the case in dispute, The Counsel for the plaintiffs perceiving this at last, appealed to his Lordship upon a material point, to stop such fishing inquiries.]

Mr. Attorney-General.—Does your Lordship think it fair for my friend to get all the improvements that Mr. Macintosh has made, so that they may be introduced into the manufactory of Messrs. Ellis and Everington.

Tindal, C. J.—Not unless it is shown they had a previous knowledge of them.

Mr. Serjeant Wilde.—My Lord, I say they did not use their own patent, and cannot use the patent.

Mr. Attorney-General.—If my learned friend will prove that, it would be a material piece of evidence in this cause; but, for the purpose of supplying this for their own purposes, I do not think that is right; I do not think he should do this for the purpose of introducing this subsequent improvement—[with respect to which a question had been put to witness]. I think it is a hard thing that the witnesses should be examined on such points.

Mr. Serjeant Wilde.—Just as hard as to bring an action against us to find out how we do it.

Tindal, C. J.—They have done it, but he says this is the only alteration and difference up to the present time.

Mr. Attorney-General.—In strictness, my friend is entitled to put the question.

Mr. Serjeant Wilde.—I have no other object except for this cause,

Mr. Attorney-General.—But it is very hard upon us; and my friend is sure I would not raise this objection unless it were necessary.

Tindal, C. J.—They do not want to know how you do it, Brother Wilde.

Mr. Serjeant Wilde.—Yes, my Lord, they do, they would be very glad to know how we do it, but I will let them alone; you want us to tell you.

Mr. Attorney-General.—We will show you the result; and you will, I dare say, show the result to be false. What I am addressing myself to is, that they should not get out from our workmen the result of improvements made down to the present time.

Mr. Serjeant Wilde.—Surely I may show you have not sufficient confidence in your own patent.

Tindal. C. J.—I must leave my Brother Wilde to be the guardian of his own *verecundia*.

By Mr. Serjeant Wilde.

The alterations we made in the machinery after we went to Manchester are the only alterations now in use in the varnishing department. We did nothing to the cloth prior to this being sold as water-proof and air-proof cloth, besides what I have now said. The alterations and improvements I said were being made every month, are in the machinery. There are alterations now going on which I cannot explain, because they are not yet completed. I do not know that there is any great advantage derived from the new machinery, except that we can do a great deal more work with it; whether cheaper, I cannot tell. The machinery is complicated and expensive. I do not know that with the new machinery we can make the article better than before; it was water-proof then, and is now. It is equally good-looking to the sight and marketable. It was equally smooth, good, and neat, when put on by a spatula, as it is now. The demand did not increase *materially* within two or three years after Mr. Hancock joined; but it has increased something within the last two years.

Re-examined by Mr. Attorney-General.

In the year 1823 there was an article known at Glasgow by the name of coal-oil. It was *very* well known by that name; it was got from the gas-works; I have been in gas-works myself, and have seen that coal-oil floating on the surface of the water obtained from the gas-works. I never heard it called by any other name than coal-oil. Without the assistance of the machinery—merely following the directions of the specification—the cloth was made perfect and as good as that now made by the assistance of machinery. In making the solution after the bits of India-rubber were mixed with the oil, the mixture was stirred; and at Glasgow the oil was evaporated by steam-pipes. After they are put together they are made perfectly dry; at the time they are put together they are clammy or sticky, and there is a complete union when dried; then the oil is evaporated, and the India-rubber only remains. There is no difficulty in making the cloth both air-tight and water-tight. The demand has increased within the last two years, as far as I can judge, considering that I had nothing to do with the sale.

Mr. Fleming, examined by Sir William Follett.

Have been in the service of Mr. Macintosh for eighteen or nineteen years previous to the year 1823, when the patent was taken out at Glasgow, superintending the water-proof cloth manufacture under the patent, according to the specification. I obtained the coal-oil from the Glasgow works and from Edinburgh. The coal-oil is procured thus:—the whole products procured from the gas-works are conducted from the retort to the cistern, and deposited there; the tar falls to the bottom; the ammonical water is above; the tar and the coal-oil float on the surface. The India-rubber was cut up in small shreds and dissolved in the coal-oil, and the solution was spread at that time over the cloth with brushes. Every piece of cloth was tested as to its being air or water proof, before it went to the warehouse. Very considerable quantities of the cloth were sold at Glasgow; we supplied some to the Government offices; the Colonial office, and the Ordnance also. I remained in Mr. Macintosh's employ till 1825, but did not go to Manchester; nor have I had any connexion with him since. While I continued with him at Glasgow, the manufacture was carried on in the manner I have described.

Cross-examined by Mr. Serjeant Wilde.

I saw the solution made by different men; it was not always one man; sometimes one, sometimes another, as the thing happened at the time; the works were all open. I was employed both in the factory and counting-house. We received the ingredients from the gas-works in one vessel under the name of coal-oil; I never heard it called coal-tar; but it might have been purified. Mr. Macintosh had a place for dissolving tar; some of the ingredients which came from the gas-works went to that factory before it came into my apartment, and it may have all gone. I have used it in the state given out in the gas-works to dissolve India rubber, but the manufacture was chiefly carried on by purified coal-oil. I have passed through the place where they were distilling the tar, but I did not attend to it, as it was not under my superintendence. The men had free access to this part of the works; there was no exclusion. There were no retorts in the factory adjoining for the purification to my knowledge; there was a still, but the size I cannot tell. The quantity of the solution used on the cloth varied according to the fabric of the cloth, sometimes more and sometimes less; but I consider if it was water-tight it was air-tight. We supplied the Colonial-office to the amount of near 600*l*., in 1824, and the Ordnance-office about the same time; and at different periods. The India-rubber was prepared to be put into solution in the manufactory which I superintended; the solvent was brought in and the India-rubber put into it. There were different persons employed to put the India-rubber into the solvent, but I cannot state their names. The India-rubber was prepared by cutting it into shreds, and then steeping it in coal-oil. The article sold at the gas-works as coal-oil. I was in the service of Mr. Macintosh long before he obtained this patent. I believe the process of purification was carried on before he obtained the patent; but I do not know for what purpose. We began to manufacture water-proof cloth somewhere in 1823. Coal-oil was at that time a substance perfectly well known under that name. These are specimens [*producing them*] of the cloth we manufactured at Glasgow. The solution was put on with the brush during the time I superintended it precisely according to the specification. The whole process was according to the specification. These specimens are impervious to air and water.

Professor Wm. Thomas Brande examined by Sir Frederick Pollock.

I am a Fellow of the Royal Society; and have addicted myself to chemistry for at least twenty-five years. I have read the specification filed by Mr. Macintosh, and have adopted the mode therein described for dissolving caoutchouc. I have applied that solution to paper, to linen, and to leather, on the plan or mode described in the specification; the result is, that the two coated surfaces adhered together, and became impervious to water, and, I presume, also to air. I did not try with regard to air; but I should think if a thing is water-proof, it would be air-proof. I have here specimens of cloth and blotting-paper which I have made water-proof, and a piece of linen [*handing them in*]. I believe that every specimen is water-proof, because I tried them. In preparing these articles I did not, in any respect, deviate from the specification filed by Mr. Macintosh. I have made some other experiments with other substances, by the direction of Macintosh, with a mixture made by a person of the name of Clark, of Bridgewater. I endeavoured to dissolve caoutchouc in a mixture of linseed-oil and oil of turpentine; I found that by boiling the caoutchouc in the linseed-oil, according to the directions in the paper which was given to me, the caoutchouc was decomposed, it became viscid, but it would not dry; but so far altered, that it was, in my opinion, not capable of being applied for the purpose which was there represented; it was not the same substance, nor again capable of being dried or resuming the appearance or properties of caoutchouc. I used the relative proportions of caoutchouc and spirits of turpentine stated in this paper, that is, one ounce of caoutchouc cut into small pieces, and eight ounces of spirits of turpentine, and afterwards added the linseed-oil, in the proportion of 70 parts, taking the other as 1 in 8. I then boiled it for about an hour, I think; and at the end of that time I found the India-rubber changed so much in its properties, that it was decomposed, or partly decomposed, and certainly would not answer for the purposes of Mr. Macintosh's patent. The action of spirits of turpentine and linseed-oil on India-rubber are perfectly different from the action of coal-oil, which softens it in the first instance, and then reduces it to a pulp. In that state it may be further diluted with coal-oil to any extent that is necessary, and then spread over linen or other articles, when the coal-oil gradually evaporates, and leaves the pure caoutchouc in, I believe, an unaltered state. I have made experiments with linseed-oil combined with caoutchouc, so as to ascertain whether it is at all useable for the same purpose which Mr. Macintosh has adopted, by spreading some of it upon a piece of paper; but it immediately ran through, and rendered the whole greasy, and I gave up the operation as hopeless. My attention has been called to a process in which the name of Mr. Weisse is connected, but I was not able to collect from the information before me any mode of following this process; the ingredients were gum, copal, resin, caoutchouc dissolved in turpentine, linseed-oil, and drying materials, which are added to linseed-oil with a view to make it dry; but they could not produce a result similar to Macintosh's. No proportions were stated, and no directions given for carrying on the process; and as, in my opinion, the oil of turpentine and other materials would not dissolve all the substances which are there stated, I did not try any experiment upon the subject. I am acquainted with the substance called coal-oil, which is, I believe, the common term used in gas-works; I have known it as such certainly for the last fifteen or sixteen years, certainly before the date of this patent *in 1823, twelve years* ago. I *believe coal-oil to be what is* chemically called one of the numerous forms of hydro-carbon, that is, a combination of carbon and hydrogen. It is found during the decomposition of the coal, and is at first a highly volatile vapour; it goes over along with the gas, and is, to the best of my recollection, deposited in those parts of the gas-apparatus which are, generally speaking, furthest from the retorts, but it may be deposited in small quantities in any part of the apparatus, either in the tar-vessel or in the purifiers; it floats on the surface of the water. Coal-tar is a different substance. Generally, coal-tar is of a greater specific gravity than water. I have seen coal-oil myself floating on the water in the gasometer-tank, and capable of being drawn off from the surface of the gasometer-tank. The coal-oil which I used in my first experiment was sent to me by Mr. Macintosh; that which I used subsequently was obtained, I believe, at a dry-salter's in Gracechurch-street; the name I do not recollect, but I rather think it was a Mr. Jones, in Leadenhall-buildings. I got it by the name of coal-oil. I did not send for it myself in either instance. In the first place, I was supplied by Mr. Macintosh; in the second, it was sent for by a friend of mine at the place I have mentioned. Experimentally, I do not know whether, if coal-tar be distilled, it yields, as one of its products, coal-oil. I never distilled coal-tar to obtain coal-oil from it. Coal-oil is not the same substance as naptha. There are many substances in commerce known by the name of naptha. There is a substance known under the name of naptha which, I believe, comes from some parts of Italy, from the Caspian, and which is obtained also, I believe, in large quantities in the island of Trinidad; it is collected there as a natural product, as a kind of bitumen. I have obtained coal-oil from gas-works myself in small quantities; and the use of the term coal-oil in the specification of Mr. Macintosh could not, in my judgment, mislead any body at all as to what was meant.

(The Jury retired for a short time.)

The Attorney-General.—In the absence of my friend, Sir F. Pollock, your Lordship will allow me to put one or two questions.

The Lord Chief Justice.—Certainly.

The mode of purifying coal-oil is well known. I believe that it either is purified or was purified, on a large scale, either in the gas-works, or in some establishment belonging to them, by distillation. I should call it coal-oil both before it is purified and after it is purified. It may be more or less purified; still it is coal-oil. It may be distilled more than once, it would then be more pure. Still it is coal-oil; and I think any chemist, or any common workman of competent skill, would know that was the way to purify it.

Cross-examined by Mr. Serjeant Wilde.

There is not any article that goes by the name of naptha which is obtained from coal-oil; I never heard of the article passing by that name obtained from the ingredients produced by the distillation of coal; I have seen coal-oil floating on the water at the gas-works in the gasometer; it was not what we should chemically call a greasy substance, but a highly volatile inflammable body floating on the water, and lighter than the water, and what in common language is called an oil; I should say not a greasy substance, but a highly volatile oil. In the natural state produced by the coal and deposited in the gas-meters and gasometers, I can speak to having subjected it to experiment; and that it is not a fixed but a volatile oil; and I have heard that it was manufactured on a large scale by one of our gas-companies, and that they found they had no sale for it, and therefore gave up the manufactory; I only speak from hearsay. I think the gasometer which I saw held from three to four thousand cubic feet; I cannot speak to the quantity of oil I saw floating on the surface of the water; the depth of the film I do not know; I never tried to dissolve India-rubber in that oil which so floats, but I should presume it would. I do not know whether the article that now is produced in gas-works in the preparation of the gas, and which passes by the name of coal-oil, whether that first passed by the name of coal-tar, and afterwards took the name of coal-oil. I presume that which I used had been collected from various sources by distillation. There are several oils which will dissolve India-rubber; but there are few, I believe, that will dissolve it so as to permit it to be restored by evaporation to its original state; some of them decompose the India-rubber, but not all of them. In the first experiment I used a pint of coal-oil, in the second two gallons were employed. I should think very probably they employed the tar and other materials collected from the various parts of the gas-apparatus, for the purpose of obtaining coal-oil by distillation. It is one of the products of the destructive distillation of coal. Whenever I have attempted to dissolve India-rubber in oil of turpentine, I have obtained a glutinous compound, which certainly did not leave it in a state fit for its original purpose. I believe it a common thing to soften it in oil of turpentine, but not to dissolve it. I do not know whether Mr. Hancock, one of the plaintiffs, has a patent for dissolving India-rubber in oil of turpentine; when I say dissolved, I mean a *bona fide* solution, not merely softening down India-rubber. I apprehend it cannot be dissolved in linseed oil without decomposition; heat must be applied, and then a portion of the India-rubber will be decomposed. Oil of turpentine will soften India-rubber and reduce it, but with linseed oil it will not form a fair solution, nor be applicable to the same purposes as Mr. Macintosh's solution. I mean, in short, it would remain viscid, and not applicable to the purpose. The experiment on what is called Clark's mixture, was made, I think, in December last; I was not acquainted with that solution before—I did not know it by the name of Blanchard's solution; I do not know whether it was a solution or not which had been applied to balloons; in my experiments I preserved the proportions though not the quantities; I steeped the India-rubber, to the best of my recollection, in the oil of turpentine, according to the directions given; I cannot say how long; it ought to be steeped a due time in the oil of turpentine until the India-rubber is in a viscid and soft state; but it was not in a state of solution when I applied the linseed oil to it. I endeavoured to imitate, on a small scale, the process which was given me, and in which, I think, three days are directed for the time in which the caoutchouc is to steep in the oil of turpentine. I have the terms which were before me when I tried the experiment; it says, "until the caoutchouc be considerably distended, or almost in a state of solution." I did not learn from Mr. Macintosh that he had purchased Clark's patent, nor Mr. Hancock's; I have not seen the articles that had been manufactured by Weisse; I had neither proportions nor directions as to the process; I believe the term coal-oil applies to the product of the coal as it is produced in the manufacture of gas, as well as to the coal-oil after it is rectified and purified. There may be a difference between the naptha which is obtained from Italy and that from Trinidad. I think it is found colourless, but that which I have seen is generally brown; it is naptha when it is in a pure and highly volatile state; petroleum is more viscid; it is another form of bitumen, in fact. I believe when petroleum is distilled, it yields a quantity of naptha, and there remains behind a substance called asphaltum. I performed the experiment which I produced on two or three sheets of blotting-paper, and two or three pieces of cloth of about the same size—ordinary sized sheets of blotting-paper in my laboratory, with a brush; I prepared them about the middle of December; I passed, in point of fact, a heavy roller over them; I was not alone when I prepared this; neither Mr. Macintosh nor Mr. Hancock, nor any gentleman connected with them, was with me, but my assistant; I dissolved the caoutchouc in oil, obtained from the gas-works under the name of coal-oil; I certainly did not go to the gas-works and collect the oil myself, and then bring it home and dissolve the India-rubber in it. I presume all the specimens of coal-oil which I have seen have been distilled; I presume it; I am not certain that it was. I shreded the India-rubber myself; I think that the colour of the oil will depend upon the part of the gas-apparatus in which it is collected. If it is floating on the tar, or in the tar-vessels, it will be probably coloured; but if it has gone on to the gasometer, then, in fact, it has undergone a distillation before it arrived there, and then it would be colourless. At the gas-works they receive and condense every thing they can condense, but I believe a great deal of this oil goes into their gas-pipes; there are in gas-works vessels appropriated for the reception of the different products; there are vessels to receive every condensable material that they can extract from the coal; one of the ingredients produced is the liquor called ammonical liquor, separated from the entire product of the gas, which is drawn off from the vessel in which it is condensed. It would not be necessary by any process of distillation to get rid of that liquor in the solution of India-rubber, as it and the coal-oil are not at all mixsible; they cannot be mixed together, they are perfectly distinct things; they are found one floating on the other, and are, I should presume, allowed to run off. It is either drawn off or ladled off—skimmed off. In the gasometer, this oil was merely floating on the fetid water. It was a gasometer which had not been emptied for many years, and on the water there was this oil floating: it was the accumulation of years, I believe. I have seen the liquor produced by the distillation of coal in the vessels in which it is collected in the gas-works, existing in a separate state. You have the oil, the ammonical liquor, and the tar; but there are a number of other products. The gas-works which I have seen most lately, are the gas-works in Brick-lane; but it is nearly a twelvemonth ago. I presume they exist in a separate state; but in order to separate them, the most convenient process is to distil the product, and then the volatile or coal-oil will come over free from the other ingredients. I should presume that the ammoniacal liquor is separated before they distil the remaining products. If I were in a gas establishment, and anxious to collect as much of the oil as possible, I should endeavour to pour it off as free as might be from the other ingredients and materials, and then I should re-distil it. I have never seen the process of preparing the solution at Mr. Macintosh's.

Re-examined by Sir F. Pollock.

I an acquainted, of course, with the mode of dealing with coal, for the purpose of getting the gas. Coal-oil is certainly subjected to a process of distillation in coming first over. All the products of coal are necessarily products of distillation; the tar, the ammonical liquor, the coal-oil, and a number of other ingredients and substances which are found, are all products of distillation: the ammonical liquor is one, the coal-oil floating on the top of that, and the coal-tar sinking to the bottom. Those are, perhaps, the three principal products, besides the gas. But there are a great number of other substances; it is a complicated product; but those are three of the leading articles. The specification speaks of the oil being pure; the mode of making a volatile oil of that sort pure, is, generally, I should presume, distillation. I have not the least reason to believe there is any difference between oil after the first distillation and after its second distillation, except in its being more pure. I have no reason to doubt when it first comes over it would dissolve caoutchouc. A friend of mine was anxious to make a solution of caoutchouc, and he applied to me to get some coal-oil, and I told him he had better go to some drysalters, and he went to Mr. Jones's, in Gracechurch-street, and they procured him some of it, which he put into my hands, and I dissolved the India rubber. That was the article I effectually experimented with.

Henry Warburton, Esq., M. P., examined by the Attorney General.

I have, for a good many years past, paid a good deal of attention to subjects of philosophy and chemistry. For the last ten years I have paid rather less attention. I have read the specification of Mr. Macintosh's patent, but not very lately, about a month ago. I am not aware of any such process being known before 1823, when this patent was taken out; for when it first came out, it was spoken of as a process quite new by those chemists with whom I had the honour of being in company at that time—the late Dr. Wollaston amongst others. I remember it being produced at Dr. Wollaston's own house; an experiment of this kind being made at that time, which fixes it on my recollection. The two portions of the cloth were torn asunder, and there was an electrical light produced by the India-rubber at the moment of separation. There was a society of gentlemen called the Chemical Club at that time, which consisted of the most distinguished philosophers of this country, of which I was a member: it was repeatedly the subject of conversation there, and spoken of as a novel and ingenious process. If there had been any other solvent known, I must have heard of it. I certainly consider it a novel and ingenious process. Its great utility, no doubt, is to keep off the rain and the weather; and there is another advantage: some gentlemen, myself amongst others, are rather fond of the amusement of fishing; we have had water-proof boots made of it, with which we are able to wade two or three feet in the channel without being in the least wet. No invention of the kind was known before, unless they were the very heavy fen boots to ensure one from the wet incident to that amusement. It has been in constant use since this invention, among the members of the Fishing Club to which I belong, and they have the highest opinion of the ingenuity of the invention. We once drank the health of Mr. Macintosh as the inventor. It is also applied to the making air-cushions for travelling: I have repeatedly made use of them to the greatest advantage: they prevent fatigue. I have no doubt, that from reading the specification, this fabric might be made. Instead of manual labour there may be power from the steam-engine, and various processes for making the fabric more smooth at the time of laying it on; like every other invention, it would admit of gradual improvement. I have never distilled coal-oil myself, but I have been at the gas-works, and I have seen the product of destructive distillation of coal. You have coal-oil, and then you have petrolium, which is rock-oil: one is supposed to be a natural product, called rock-oil; and the other is a product from artificial distillation, and is called coal-oil. Petroleum is found floating on the surface of some mineral springs, and in the Caspian; it is distilled in large quantities, and naturally; coal-oil is found floating on the ammoniacal liquor. The obvious mode to purify it, is to distil it at a moderate heat, though I cannot say so from any experiment. I should say the heat at which it distils is so low, that it could not undergo any decomposition during the process, which would be known to any person moderately skilled in chemical processes; I should have thought it was almost an elementary proposition.

Cross-examined by Mr. Serjeant Talfourd.

I must have first heard of this process about 1823 or 1824. I was first informed of it by Dr. Wollaston, as being a substance perfectly flexible and water-proof, and very light in its texture. I am not aware that the same kind of result had ever been produced before. I never heard of any thing made impervious to water and air, and being at the same time flexible, and that would bear the creasing about the person. I am not aware that a gentleman of the name of Clarke was manufacturing a patent article under the description I have mentioned; I never heard of it. I did not exactly hear the purpose to which it was applicable, but I heard there was a person of the name of Hancock, who had some process or other which was likely to interfere with Macintosh's; but I never heard of it until after I had heard of Macintosh's. I heard that in some way or other it was likely to interfere with Mr. Macintosh's patent. I never made inquiries into the details of Mr. Hancock's course; I think I was informed by Sir Humphrey Davy of the circumstance, and he mentioned something about cutting India-rubber into pieces, and by heat and pressure uniting them into one substance—I think that is what I heard at the time. A solution of India-rubber in ether has long been known and described in all the works as a varnish which was applied for rendering air-balloons air-tight. This varnish was not interposed between two folds, but as an exterior coating. There is great advantage in having it interposed between two substances, particularly for the purpose of making the air-tight articles; and for water-proof, in having two substances instead of spreading it over the surface. India-rubber is distensible, as is shown by the balls blown out (which children use,) by means of forcing the air into the interior of a bottle of India-rubber. If you were to surround that bottle by a substance of cloth which is not distensible, you would prevent it from stretching, and that, no doubt, is the use of the linen outside. The India-rubber is impervious to water and air, and the exterior being covered with a linen coating, prevents the distensibility of the India-rubber; being interposed between the two pieces of cloth, it is kept from being distensible

By Mr. Serjeant Talfourd.

Suppose the varnish becomes part and parcel of the cloth, which is that which is not distensible; how could the tendency of it to distend at all interfere with the convenience of such a subject?—The difference between the two would be this: this would be probably equally indistensible, but you require an exterior cover on both the surfaces of the India-rubber, otherwise the India-rubber would wear off, and it would be wholly unfitted for the purpose of wear if you had not the protection of linen or other texture on both the surfaces of the India-rubber. In my judgment it would not last unless you were to renew the India-rubber. Now, the cushions which I have travelled with do not require renewing; at least, I have had one three or four years, and I have not found that it has required renewing in that time. I have never heard of any patent of Hancock's, for making bags air-proof, which he produced by dissolving India-rubber in spirit of turpentine. The article commonly called coal-oil is produced in the distilling of tar, but in what proportion I cannot say.

Re-examined by Mr. Attorney-General.

I should think that the purified coal-oil is affected in a small degree by the quantity of tar it has in solution. It may require a larger quantity to produce the same effect if in an unpurified state. The oil found floating on the ammoniacal liquor, and the oil which is produced by the distillation of tar, are, I have no doubt, the same oil, but I have not made any experiment; they are both coal-oil, possessing the same qualities. If fishing boots were made by merely applying varnish to the exterior surface, I think the sand would rub off the varnish, and make the substance no longer water-proof; and if you put it inside, the feet would be in a bad way. I apprehend, by adding cold linseed oil to India-rubber, you would not decompose it, but you would have a solvent which you cannot afterwards get rid of; if you employ linseed oil hot, then you would decompose the very substance of the India-rubber; but in either case I know, from having made experiments, that you will have a glutinous substance which will not be like India-rubber. By employing cold oil, it is so volatile it would be easily got rid of, and the India-rubber would remain in its pure state with its original qualities. When coal is distilled for the purpose of making coal-gas, that is what I call destructive distillation. In order to produce it, you require a high temperature; but when it has been once produced, then it will evaporate at a low temperature, and that I do not call destructive distillation.

George Frederick Daniell, Esq., examined by Sir Frederick Pollock.

I am a Professor of Chemistry at King's College. I have read the specification filed by Mr. Macintosh, and, as far as I know, the manufacture described by Mr. Macintosh is new, and was not known before his patent was taken out. There had been attempts made to produce a fabric that should be water-proof, and at the same time flexible, such as the oil-silk used for umbrellas; but, as wearing apparel, certainly any body who has seen an oil-silk umbrella, would not wish to wear it, as a cloak or any garment. I have seen a very coarse sort of fisherman's cloak or hat cover made of it. They were liable, on use, to crack, and allow the water to go through. Mr. Macintosh's manufacture is free from those objections; I have had experience in the use of it as a cloak and as air cushions, and I believe their quality remains as long as the stuff they are made of. In my judgment it is new, and also very useful indeed. I have taken the specification, and gone through it for the purpose of making a similar article myself. The coal-oil is an article well known in commerce, and I knew it before the date of this patent, which was in 1823, but I cannot assign date to my first knowledge of it; I have known it ever since there have been gas-works. *I got the coal-oil from a drysalter—I think in Thames-street,* at Price and Co.'s. I inquired for it as coal-oil. I wrote down on a piece of paper, "coal-oil for the solution of caoutchouc." I sent my assistant with that note, and he returned with it to me. It was well known to me before, though I had none of it by me. I then pursued the process of dissolving the caoutchouc, and applying it to substances described in Mr. Macintosh's specification, and found it succeeded perfectly. I have some small specimens here which I made. This is a piece of blotting paper, which has been rendered water-proof by that process.—(*Producing the same.*) The surface will imbibe the water, and the water will run over it, but it will not pass through to the other side. Here is a piece of paper which has been torn wet, which shows the films of caoutchouc which lay between, showing that the caoutchouc is not altered in its properties. If I were to moisten this paper, and reduce it to a pulp, I might remove it, and I should then have a film of India-rubber. This is some of the cloth.—(*Producing the same.*) In making these articles, I pursue precisely the directions that are given in Macintosh's specification regarding the proportional quantities. I have not the slightest doubt that any person ordinarily skilled, from the statement made in the specification, would be able to produce this patent. When an article of this sort has been discovered, I presume there may be in the course of the manufacture improvements in the mode of laying the cloth down to receive it. Mechanical improvements would naturally occur to a person who was working on a large scale, to do away with manual labour. They are not at all essetnial to the manufacture itself. I began with very clumsy tools—with a common brush and a piece of wood. This is some of the solution: it is of the consistence of honey — [*producing the same*] — and is spread about with a piece of wood on the surface of the cloth, and then another piece of cloth is applied, and then pressure. This is a portion of the solution that I used. I have a specimen of the India-rubber after it has gone through that process with the evaporating, sufficient to show the caoutchouc; it contains all the properties of the caoutchouc. According to my experience, this which is the evaporated solution is not distinguishable in any of its properties from India-rubber; it has a slight smell, but nothing else, which is the remains of the coal-oil. I tried a process which has been called Clark's process, which is mixing caoutchouc and spirits of turpentine, and then adding to that some linseed oil. I think my process was the same as Mr. Brand has described; it was first of all softened by the operation of turpentine, afterwards added to oil, and the whole boiled together for some hours. It was two days in softening. I continued the process until it was perfectly soft, like a kind of jelly. I endeavour to apply that to making a similar manufacture. Here is a specimen.—[*Producing the same.*] I tried to produce the same effect as I did with Macintosh's process; it was in December, and it has been laying in that state ever since. There are two pieces; the upper part is a piece of the original cloth; the under piece consists of the two cemented together. I tried to dry it in a sand bath several days. The process of softening the caoutchouc in spirits of turpentine, and then adding linseed oil, is not similar to Mr. Macintosh's in the slightest degree. In the first place it is utterly decomposed. I thought it remained theoretically, but I tried an experiment to determine. I placed some India-rubber in a metallic vessel, so that it should be exposed all the time to the temperature of the boiling oil, and this is the result; though it has been so long in this state you will find it is not dry, and, probably, never will dry: it is much more of the nature of birdlime.

Mr. Serjeant Wilde.—This is birdlime, gentlemen. You know it, I see.

Do you know whether there are any other modes of obtaining coal-oil except by distillation from coal?—Coal-tar will also produce it. However, from whatever source it comes, it is, speaking chemically, the same substance; and whether more or less pure, I should still treat it as the same substance, and give it the same name of coal oil? Undoubtedly, it is known by other names, but coal-oil or coal-naptha is the term it is generally known by.

Cross-examined by Mr. Rotch.

I am not aware that the name has changed at all since former times. In trying these experiments I sent to a dry-salter for it; I cannot say where I should have sent for it in the year 1823; perhaps to the gas-works. When I say it has become better known, I mean it is in more extensive use. I think nobody in 1823 would have doubted what coal-oil meant. In asking for this, my assistant stated, that it was coal-oil for dissolving caoutchouc, to ensure it of a pure quality more effectually to answer the purpose, as described in the specification; the specification itself states, that in proportion to the purity of the oil the process is better. You are directed in the specification to take a larger quantity of that which is not pure: it was for that reason (to guide me in the quantity) that I wished to get the best quality. I am well acquainted with gas-works, and have observed this very collection of coal-oil floating on the water of the gasometer; it is well known, it is stated, in all the works upon the subject. In a work of great authority by Dr. Hewit, in an able article, you will find it stated, that the petroleum floats on the water of the gasometer. Petroleum is mentioned by Dr. Hewit as floating on the surface of the ammoniacal liquor. I should draw no distinction between the term petroleum and coal-oil under such circumstances, as petroleum drawn from the manufacture of gas in my mind accurately describes what is otherwise called coal-oil or coal-naptha. I should not call coal-oil in its pure state, uncombined with any bituminous matter, petroleum; but when it is so described, I should know what is meant. I do not consider the matter which is floating on the gasometer to be petroleum; I believe it to be coal-oil, but not in its pure state; I have never had an opportunity of trying to dissolve caoutchouc in the coal-oil in the state in which it is found on the surface of the water in the gasometer. The solution which is in the little gally-pot, which has been handed round, when evaporated is reduced back again to the substance of India-rubber; there is nothing in it but caoutchouc and coal-oil. If there were two pieces of cloth with this mixture interposed and the solvent evaporated, nothing would remain between the two pieces of cloth but pure caoutchouc. I am not aware of any apparatus being constructed in the manufacture of gas for the purpose of collecting this coal-oil in a pure state. I have no doubt that the gas-works provide means of manufacturing this for some purpose of commerce; but I do not know it from actual observation. I dare say there are many extensive manufactories of coal-oil now in operation that receive the coal-tar as manufactured in the gas-works for the purpose of so converting it, but I do not know it—I have no doubt of it. A great deal of the coal-oil is produced from coal-tar, as well as the other products of the gas-works.

Re-examined by Sir Frederick Pollock.

In my judgment, the substance that is to be used is clearly pointed out by the specification.

The Attorney-General.—It may be convenient that we should now examine a specimen of the defendant's manufacture.

Mr. James White examined by the Attorney-General.

About the latter end of October I went to the shop of Ellis and Everington, in St. Paul's Church-yard, by the direction of Mr. Blunt, the plaintiff's attorney, to buy a water-proof cloak; I asked for one of Macintosh's water-proof cloaks; they at first said they had not any, and recommended me to buy one which they produced of their own manufacture, stating, that various complaints had been made of Macintosh's. I bought one of each; they at first said they had none of Macintosh's, but they eventually produced one. I have now one, that one that they said was their own manufacture. I cut off some pieces of this cloak myself, and livered one to Mr. Garden in Oxford-street, and one to Mr. Cooper of Blackfriars-road, and one to Mr. Phillips of St. Thomas's Hospital.

Cross-examined by Mr. Serjeant Talfourd.

I am sure that they told me the other cloaks were manufactured by themselves; they said they had bought the interest of a person in the patent, and my impression is, that they mentioned the name of Fanshawe, and that this was manufactured according to Fanshawe's patent. It is labelled "Fanshawe's Improved Patent India-rubber Waterproof Cloak."

Richard Phillips, Esq., examined by Mr. Serjeant Bompas.

I am Lecturer on Chemistry at St. Thomas's Hospital; I have seen the specification of Mr. Macintosh's patent, and have carried through the process mentioned in that specification. The specification is such that I could clearly understand the mode in which it was to be applied; and I applied the mode described in the specification to the manufacture of those articles that I now produce. That is a piece of silk, and here is the same water-proof; there is a piece of blotting-paper, and here is the same water-proof; these are made exactly in pursuance of the specification. I have for several years known the substance called coal-oil; it has been generally known in commerce under that term. I sent for some to Cassell's works, Mill-wall, Poplar. Mr. Cassell is a person who prepares this oil and purifies it. I do not know him personally. When it was produced, it was the substance I had before known. I have not been much accustomed to gas-works, but I have been there occasionally. Coal-oil is one of the products of coal when distilled. If coal-oil is wished to be purified, it is re-distilled. Re-distillation is a mode of purification which is commonly known by all chemists. Coal-oil is an extremely volatile substance; its nature is not at all changed by re-distillation; it is more volatile than coal-tar. If mixed with coal-tar, it can be separated by re-distillation. Ammoniacal liquor is one of the products of coal in destructive distillation. The coal-oil is lighter than the ammoniacal liquor. I tried some experiments, according to Clarke's receipt, in the proportions of the substances that were given to me. "To one ounce of caoutchouc, eight ounces of spirits of turpentine, and seventy ounces of linseed-oil." The effect of the linseed-oil heat being applied, was to decompose the India-rubber. I put the caoutchouc in a different vessel, and then immersed the vessel in oil, and heated the oil, consequently the *India-rubber which is here contained, was exposed to the temperature of the heated oil, and I found* it had undergone a great change: the India-rubber which was in the oil underwent a similar change. When the India-rubber is wholly or partly decomposed, it does not retain its elasticity, it becomes semi-fluid. I find that it adheres to the finger, and becomes almost as tenacious as birdlime, and cannot be dried again so as to restore it to India-rubber. It is rendered more fluid by the change it undergoes, but it cannot be rendered solid again. I did not try whether linseed oil or grease produces any effect on the India-rubber when cold. I have got some specimens of the effect in applying the substance which I thus procured according to Clarke's plan, to, some fabrics.—(*Producing the same.*) This was made fairly according to Clarke's directions. I tried it at different times in boiling; for instance, after the first two hours, another portion three hours, and then another after three hours more. I heated it at different periods. At which ever period I took it, it did not answer the purpose of Macintosh's patent, as I think will be evinced by these specimens. Some of these are done singly. Here is one which is done double, but you observe they have not adhered together; putting them by, they separated; and it immediately ran through this stuff, although it is very thick. Here is a piece more, part in its original state, and part where it has ran through. (*Witness produced the specimens.*) I have seen an account given by a person of the name of Weisse. Forming the best judgment I can, and having the materials given without the quantities, in my judgment, they could not form a substance that would produce the effect of Macintosh's. I received a piece of a cloak from Messrs. Blunt, Roy, and Blunt; a piece of the cloak the last witness bought; it bears so great a resemblance to Macintosh's, that I can see no difference. It is a double texture, and caoutchouc is employed in the same situation with respect to the double texture, as Macintosh's. Here is a piece of the caoutchouc I obtained. I put the piece into coal-oil, which dissolved the India-rubber which was then in that material; and I got the India-rubber from it, that satisfies me that the cloak had been made with a solution of India-rubber. In my judgment, these are precisely the same materials.

Cross-examined by Mr. Serjeant Wilde.

I think I knew this article coal-oil, very soon after Mr. Macintosh took out his patent.

Re-examined by Mr. Serjeant Bompas.

This is a specimen, made according to Clarke's specification; I immersed some linen into the preparation which we call Clarke's for a minute or two, and hung it up to dry in a dry place covered from the wet, but in the air: I left it there twelve days; and after that I exposed it again, in a situation calculated to dry it if it would dry. I did not apply heat, because it is not directed to be applied in the specification. I should now call it dry; although some parts of it are not. This is another specimen which has been made seventeen days longer. The one which is nearly dry is a single fabric.

John Thomas Cooper, Esq., examined by Sir William Follett.

I am a Professor of Chemistry at Westminster Medical School. I have seen this specification of Macintosh's; I tried, according to the specification, to make the manufacture as there described. I proceeded entirely according to the process mentioned in the specification—nothing else to guide me, and I have some of the specimens of cloth here, showing the result. I succeeded perfectly in making a fabric impervious to water and air. I tried it both on cloth and paper; cloth on one side and cotton on the other. I sent for the coal-oil myself, to Cassell's manufactory, where they distil or purify coal-oil. These are bottles of the varnish, which have been prepared from the different oils. This is Cassell's oil, with bottle rubber. These are some of the specimens which I have tried with the coal-oil from Cassell's and the India-rubber with which those cloths have been cemented. I tried some experiments on what is called Clarke's patent. I followed the recipe which was given in the affidavit of Clarke, which was sent to me, and made some of Clarke's varnish: I was not able to make any thing from the directions which would answer the purpose; the cloth experimented on is pappy in some places; neither is the fabric impervious to air or water, and the India-rubber has undergone a total change, a total destruction. Here is some of the India-rubber which was put in the oil while boiling, and you observe it is quite changed. I immersed it in the boiling oil. Coal-oil is perfectly well known; I have known it sixteen or seventeen years at least, I have seen it at the gas-works, swimming on the surface of the ammoniacal liquor; and what I obtained for the purpose of experiment at the gas-works was dipped off with a ladle, from the surface of the ammoniacal liquor. I tried that with the caoutchouc, according to the mode as described; and the varnish so produced is equally effective for the purpose of manufacturing fabrics of this sort. The coal-oil was not re-distilled; it was just dipped off from the surface of the ammoniacal liquor. The coal-oil is made pure by the distillation; it is not necessary to have a larger quantity of it to produce the effect, but it requires a greater quantity of crude oil to dissolve the same quantity of India-rubber. I have called it crude oil to distinguish it from the oil that has been re-distilled; the effect is the same, except that it makes the fabric a little more stiff in consequence of the tarry matter that it leaves behind. You will find that that piece is not so flexible as the other. The purer the oil the better, and so says the specification. The mode of purifying this coal-oil is a thing perfectly well known to chemists; it did not require any deep science to know how to pursue it, nor any direction in the specification—any body at all acquainted with the subject would know how to set about it.

Cross-examined by Mr. Serjeant Wilde.

I distilled coal-oil myself, I think, about sixteen or seventeen years ago, I cannot exact tell when; it was that which was obtained at that time in small quantities from the surface of the gasometer-tanks. I collected some lately from the South Metropolitan Works in the Kent-road—about a quart. I went to the place and procured it myself; it was not procured from the gasometer, it was procured from the surface of a very large tank. I had not made any application on the subject of obtaining it before I went to get it. I did not do it myself, it is a nasty, dirty operation; I stood by and saw it done, some of the men did it.

(To be continued.)

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NOTES AND NOTICES.

Metallic Lighthouses.—Mr. Samuel Brown proposes employing bronze or cast-iron in the construction of lighthouses, instead of stone. He seems to have made out that a bronze lighthouse would be incomparably cheaper than a stone one, that it would be more secure against dilapidation or subversion by the waves, that the lights would be better protected from the spray by which they are occasionally extinguished, that it could be erected in one-twentieth part of the time, and in situations where a stone structure is impracticable. It has been proposed to place a lighthouse on the Wolf Rock, near the Land's-End, a position where it would be exposed to the most violent storms of the Atlantic; and a plan was drawn up for the purpose by Mr. Stevenson, who holds a high rank in this department of engineering; which plan, Mr. Brown thinks, would require 15 years for its execution, and cost 150,000*l.* Mr. Brown undertakes to erect one of bronze, 90 feet high, which would answer the purpose as well as the stone one of 134 feet, for 15,000*l.*, and to complete it in four months.—*Scotsman.*

Communications received from Mr. Tait—Mr. Harris—I. S.—A Constant Reader.

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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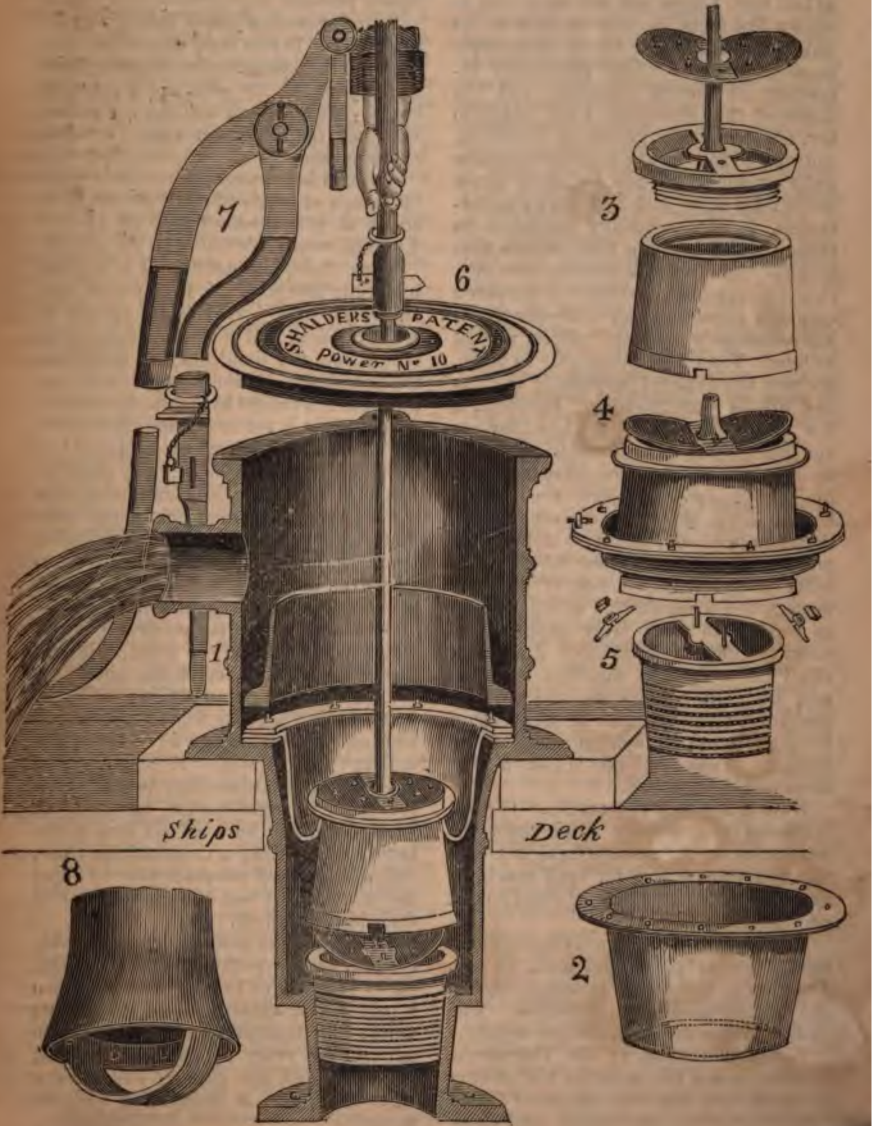
SHALDERS'S FOUNTAIN-PUMP.



SHALDERS'S FOUNTAIN-PUMP.

Sir,—There has been much said for and against my new rolling principle in pumps, in your popular work. First, Mr. Hay (vol. xiii. p. 357), and many others since, have clearly proved that the principle is good in theory; and now that I am at last able, I hope you will permit me to state a few facts, in order to show to the public that it likewise proves extensively good in practice. The predictions respecting its limited operation, and the frailty of the connectors, I am happy to say, are practically proved to be wholly untrue. Many impatient gentlemen were quite confident the new principle would never raise water 100 feet high; nevertheless, it is successfully employed in raising water to more than double that height. And notwithstanding the mischievous opposition which this *mariner's guardian angel* has had to encounter, it has preserved some ships' cargoes as well as lives. Too various, even only to name, are now the different purposes of application of the fountain-pump; therefore, a few cases will suffice to prove they are not expensive to keep in order when well fixed at first, whether used for extensive or limited purposes. Neither the passive nor the active cones are subject to wear, therefore need no remarks; but practical proofs were wanting to establish the durability of the flexible cones, or the connectors, to the satisfaction of such parties as wanted to raise large quantities of water to different elevations. A superior effect has ever been manifest with the new frictionless pump over the old friction-pump; so that, in fact, what would be the expense for wear and tear of the connectors was the only question that remained to be settled.

Now mark well the results. For the following four important purposes the connectors on an average have not cost three shillings a year for each machine, and have been tested from 10 to 100 feet perpendicular height:—

The first fountain-pump that was sold raised the water 10 feet high, at Mr. Doughty's, Brockdish, to supply one of the largest tanneries in Norfolk. The first connector lasted thirty-five months.

A fountain-pump at Mr. Thornton's, Beccles, raised the water for his brewery *about 30 feet;* the first connector lasted *seventeen months,* and others used since *have lasted* considerably longer.

A treble-motion horse fountain-pump at Messrs. Youngs and Burt's, Norwich, raised the water for their brewery nearly 50, and sometimes more than 100 feet. The first connector of the three failed in the twentieth month, when the second was almost worn out, but the third continued perfect.

A treble-motion horse fountain-pump at Messrs. Taylor and Dyson's, Diss, Norfolk, has raised the water for their brewery about 100 feet for more than twenty-one months; and the connectors were all found perfect upon a recent examination.

A single horse with this machine raises 80 barrels of water in an hour, which is equal to 400 barrels raised 20 feet, or 4,800lbs. raised one foot high per minute.

Thus, then, the stability of this great hydraulic invention has been proved conclusively; fully justifying the opinion of Dr. Birkbeck, that "the fountain-pump is free from the liabilities and defects of the common friction-pump, and approaches to a perfect hydraulic-machine."

So perfect is the new pump, that when the column of water which is wanted to be lifted weighs 995lbs., a weight of 1,000lbs. at the opposite extremity of a true balance will preponderate and raise that column of water; while so defective are those on the old principle of construction, even in their best condition, that 73 per cent., upon an average, over and above the weight of the column of water which is wanted to be lifted, will but just overcome the friction resistance.

If a fountain-pump deliver 20lbs. of water 10 feet high, or 2lbs. of water 100 feet high per stroke, and a friction pump deliver 12lbs. of water 10 feet high, or 2lbs. of water 60 feet high per stroke—four men of equal power, one man at each pump, will work all day long at the same speed. Make a thousand fair trials, and this in round numbers will be about the result whilst both pumps continue in their best condition.

But in practice the gain is considerably greater, for the packing of the friction-pump soon begins to wear away, and then a part of the water repasses the piston; whilst the fountain-pump continues to perform for years without the slightest variation, and the gain is still greater when sand, &c. is intermixed with the water.

If the stroke, or rather the dip, be

taken too short, but in the right position, the machine works the lighter, but delivers only part of its proper quantity of water. If the dip be taken too long, or in the wrong position, or if the expresser-valves are too contracted, or work stiff, it is fatal. By lengthening the rod of any of the three fountain-pumps I shall next notice, only one inch, it would cause a jolting action; or, if the rod were shortened one inch, a new connector would not last one month. However, many engineers can now adjust the new principle with sufficient accuracy; and when all engineers can do the like (and why should they not?) the frictionless pump will be the only one used.

The working parts of fountain-pumps for deep wells, are contained in an accessible chest, when the rods work internally, which is of considerable importance, as the trees or other tubes never want to be unfixed, and any reparation is instantly effected.

For each of the three mansion-houses following, the connectors have not cost one shilling a year:—

1. A fountain-pump ordered by Joseph Pease, Esq., M. P., has raised the water for Eaton Grove House about 100 feet high thirty-eight months, and the connector is now in good action.

2. A fountain-pump had raised the water for the mansion of William Unthank, Esq., about 70 feet, for thirty-two months, when the connector was destroyed by the top part of the rod being accidentally dropped after the rods had been uncoupled.

3. A fountain-pump for the mansion of T. Steward, Esq., Heigham Lodge, has raised the water about 115 feet for twenty-three months, and the connector is now in perfect action. With this machine, upon the new principle, a man was found to fill a tank with water in less time than it had before taken a horse to fill the same tank upon the old principle.

For ten long years has the matchless fountain-pump been charged with frailty in respect of its connector. I will now sum up the evidence before the public in one question for an unqualified verdict. *Is there any thing alarming in an annual expense of about ten shillings for all the connectors to these seven fountain-pumps, which cost upwards of five hundred pounds in completing, and some of which lift half ton long columns of water?* In fact, there are eleven fountain-pumps, two of the public breweries having each a treble set.

So much then for the frailty of the connectors. Can pistons be packed cheaper?

Is there any thing so charming in the dear old pipe and plug-pump, that half the power of poor mortals, *even in the hour of peril,* should continue to be destroyed by its palpable defects? Or are any of those gentlemen who make a general charge against me of bombastic, unintelligible jargon competent to establish a single case of failure?

Why should inquirers after truth regard *opinions* about the different powers of the various kind of pumps at all? It is a subject above which there is no mystery, and demonstration is easily attainable; for raising a fluid or raising a solid, is nothing more than lifting a weight from a lower to a higher situation, be it a pound or be it a ton. Therefore, scientific gentlemen ought to take pains to ascertain, for the guidance and good of the public, and for future ages, whether the proper application of the new principle will constitute perfect hydraulic machines or not? And to this end they would do well to consult the excellent remarks of Mr. Trebor Valentine, vol. xx. p. 56.

Any person of common sense can easily prove that the best piston-pump in the world is a most deplorably defective machine by a decisive experiment without expense. As a 13-feet circular inch-pipe contains 71 ounces of water, a pipe of the same length 4 inches diameter contains 71 lbs., and a 6-inch pipe 160 lbs. of water. The last is the proper size for a pump of that length for a man's power; 164 lbs. being the weight of each column of water in Mr. Booth's pumps. But take a 5-inch ship's pump, 13 feet long, from the surface of the water to the top of the delivery, with a truly bored brass cylinder, and a piston well fitted, with a properly cupped leather, which pump lifts a column of water weighing 111 lbs. when the pump is in its best order; take off the lever and fix a pair of scales over the pump; weigh the rod till the piston descends, and its buoyancy, with the downward friction, will be overcome; but the resistance with that of the upward friction will be added to the weight of the column of water. Then attach the pump-rod to one scale, and put weights into the other scale till the piston ascends with the column of water. If the piston rises without leakage with 112lbs., deem it a perfect machine; with 120lbs., a tolerable good pump; with 130lbs., very defective; 140lbs., intolerable; if 150lbs., it proves that the water wedges the plug very tight in the pipe to cause such a dead resistance. But should it require 160lbs. to raise the 111lbs. column of water, knock the barbarous machine to pieces, rather than put it on board a ship to be the destruction of entire ships' crews.

For nineteen days and eighteen nights the fountain-pump was in action without a minute's respite, and saved the Argus brig, bound from Cadiz to London; which, when three days out at sea, sprung a leak, and soon after the friction-pump became useless.

Thousands of ships have been lost in as many hours through the defects of the wretched friction-pumps; and it must be admitted, that as the fountain-pump, with the power of only one man at a time, will discharge 200lbs. more water per minute from a ship of ordinary draft, it thus prevents an accumulation of more than 100 tons weight of water in a ship, in less than nineteen hours. What reasonable man can expect a good effect from that leaking, scraping, choking, uncertain, and inefficient disgrace to science, the common pump? The smallest profits should be and are charged upon ships' fountain-pumps, and not more than *6s. 6d.* for No. 10; *8s. 6d.* for No. 8; or *13s. 6d.* for No. 5, connectors.

A single experiment of the kind just stated, would remove any veil from the eyes of my scolding friend Rutter (vol. xix., p. 347); but can he persuade my opponents to bring forward the best chain-pump, the best common pump, or that pretty toy, De la Hire's pump (which are all of the friction family), or the screw-pump, which is founded upon a brilliant idea; or as many more as they please, to be placed in a reservoir by the side of the fountain-pump, for fair trials, to raise water equal heights by manual power? No, they are afraid their good pumps should appear like so many good asses, going three miles an hour after a good horse *going fifteen miles* an hour, so that the *further they* might go the further they *would be off.*

In some tanneries (where bark liquor only is used), as many as six fountain-pumps are constantly employed; their average wear and tear is about five shillings per annum. There have been three in the largest tannery in Norwich nearly six years. Mr. Rump, the owner, and numerous other tanners, declare that each fountain-pump is a clear annual benefit ticket of at least 10*l.*

Labourers admire the new method of pumping or rather weighing up the liquor instead of scraping it up with that distressing old tool the leather hoe, commonly called the packing of the piston.

At Reedham, to aid the paddle-wheel and raise the water when too high for the wheel, there is a treble-motion fountain-pump which delivers 1,000 gallons of water per minute; the first connectors have been in action forty months. Fixed for T. T. Berney, Esq., by his own engineer, under his own direction.

At Acle Marsh there is a double-motion gravitating fountain-pump for the like purpose, of a larger capacity, the connectors of which have been in action sixteen months.

Last spring there was fixed in Lincolnshire, to supersede the paddle wheel, a double-motion fountain-pump, which delivers 12,000 barrels, or 2,400 cubic yards of water per hour, showing a stream at the sluice 26 inches deep and 52 inches wide. (I would just remark, that if the stream were 1 foot deep, and 9 feet wide, 14 inches in height would be saved, and lifting 12,000,000 gallons of water 1 foot too high every twenty-four hours, consumes a great deal of power;—water should be delivered at the lowest level possible.) The first performance of the above machine was witnessed with considerable interest, and it is now calculated, that by making it a treble acting machine it will drain 5,000 acres of marshes.

Thus now the new principle in pumps has passed the practical ordeal by sea and by land, both upon a small and a large scale, and both for low and high elevations. Any engineer having acquired proper knowledge in fixing fountain-pumps, may ever after defy all competition with any other hydraulic machine in existence; for although there may be some gentlemen so hardy as to propose that a piston can be made to fit the cylinder of a pump tight without touching, or touch without retarding, or to act free from the cylinder without the water repassing the piston; yet, nevertheless, propositions of such monstrosity a jury of old women would laugh to scorn. However, for the good of society, I hold every one of my opponents in derision, regarding the best performance of the best bored pump in the world, merely as a burlesque upon the art of raising water.

I beg to wind up this correct report of the progress of the fountain-pump, which is an invention of immense importance to the world, by introducing four testimonials, two for land and two for sea.

Yours truly,
W. SHALDERS, Patentee.
Bank-place, Norwich, March 2, 1836.

Sir,—The fountain-pump power, No. 4, that I bought of you in March, 1832 (for 12*l*.), throws nearly eight imperial gallons of water per stroke; when two men work briskly it delivers 470 barrels or 100 cubic yards of water per hour. It answers the purpose exceedingly well for my dam-works at Horsted; being for excavation work vastly superior to the common pump, or to Archimedes' screw-pump. Convinced that this statement is due to you as the inventor, you are at liberty to make it public.

I am, Sir,
Yours respectfully,
THOMAS WATTS.
To Mr. W. Shalders. Pit-street, Norwich.

Copy of a Letter from John Cozens, Esq., Alderman of Norwich.

Sir,—I have lived long enough in the world to know that all alterations are not improvements, and also that many who profess by improvements to accomplish much, fail in the performance; on the other hand, that there are some few who whilst they promise much perform what they promise. In this class Mr. William Shalders, the ingenious inventor of what he calls an expressing-fountain, deserves to occupy a distinguished place. To all those acquainted with the principle on which the common pump acts, it is well known that there is great resistance from the pressure of the sucker against the bore of the pump. This resistance Mr. Shalders has, by his important improvement, totally removed. In my situation we are eighty feet from water, and with my former pump it was very laborious employment for two powerful men to pump the quantity of water almost daily required. By the improvement effected by Mr Shalders, one man can pump the same quantity of water with great ease. If any one after this be still doubtful, I invite that individual, as I do any one interested, to come and examine for themselves.

I am, Sir, yours truly,
JOHN COZENS.
Sprowston Lodge, near Norwich,
July 3, 1834.

This is to certify that Mr. Cracknell supplied the ship Eagle with those fine invented patent fountain-pumps, and I have no hesitation in recommending them to ship-masters and owners for their utility in discharging a greater quantity of water with less labour than any pumps I have seen during my time of upwards of twenty years as commander.

CHARLES PATTERSON,
Commander.
London, July 25, 1835.

Copy of a Letter from Captain John Waters, Owner, and Captain Goodridge, Master, of the Friends' Goodwill.

Dear Sir,—We feel great pleasure in informing you, that the fountain-pump, fitted by you on board the Friends' Goodwill, has answered almost beyond our expectations. On her voyage to St. Michael's she encountered severe and heavy gales of wind, and by a heavy sea striking her, she started a butt's head, and had it not been for the ease and facility of the working of the pump, and the great quantity of water discharged with comparatively so little labour, *we feel convinced the ship must have foundered.*

We are, dear Sir,
Your obedient servants.
JOHN WATERS, Owner.
J. GOODRIDGE, Master.
To Mr. E. Cracknell,
Wapping.

Description of the Engravings, by Mr. William Shalders, Junior.

Fig. 1 represents a perspective section of a power No. 10 ship's fountain-pump resting on the ship's deck, with all its hydraulic working parts complete, as designed and put in practice by me on my father's patent principle. The fountain, or receptable for the works, is a casting composed of a mixture of lead, zinc, and tin; if of cast-iron, it is necessary to line the passive cone or stay, against which the connector is supported, with sheet-brass or lead.

Fountain-pumps of various powers, made in a similar manner, are well adapted for brewers, dyers, maltsters, domestic use, and many other purposes.

It must be observed, that in this figure the expresser is shown considerably smaller than is set forth in my graduated working-scale; this gives room to show the action of the connector more conspicuously; also to show the bottom butterfly-valves, they are removed lower than is advantageous in practice.

Fig. 2. The connector or flexible cone. This is blocked, without any seam, from a flat disc of Millband leather, being first properly prepared; holes are punched in the external flanch or rim, which is screwed between two flat brass rims, as shown in figs. 1 and 4.

Fig. 3. The brass or gun-metal expresser and rod, showing the bottom or active cone unscrewed from the top part. In this figure the butterfly-valves, made of leather screwed between sheet-copper or brass plates, are shown ready to be dropped on and fixed to their seat below by thumb-screws and bridge-bars, or as in fig. 5.

Fig. 4 shows the connector as fixed by

the screw of the expresser, also a leather collar or washer fixed by the same screw-joint, to preserve the connector from injury, and likewise to assist in maintaining its proper action.

Fig. 5. The brass-bottom valve seat or lower bot. The butterfly-valves are not shown in this drawing, but are made like the expresser-valves, and being dropped over the screwed steady pins, are fixed to their seat by the brass bridge-bars and nuts, shown on each side the figure.

Fig. 6. A cast-iron lid or cover to the fountain-pump.

Fig. 7. The wrought-iron lever and lever-bracket, drawn to scale, the straight portions of which are not shown. This bracket should stand up not much less than 4½ feet from deck. The shear and shear-hole will show how it is fixed after being dropped through the receiving-socket, cast upon the cistern-head of the fountain-pump, as seen behind the copper expresser-rod. The openings in the lever-bracket and rod are made deep enough to admit a strong wood handle if preferred.

Fig. 8. The end of the feed-pipe, which may approach the ship's outer planking as near as the semicircular foot will allow. It is best made with a trumpet-mouthed entrance, unguarded, which gives a capacious waterway; any light matter, such as chips, pieces of cordage, grain, &c. &c., that may find their way to the ship's well, had better be pumped up the pipe and through the valves, which is the easiest method of removing such obstructions.

It will readily be perceived from the foregoing description that the utmost simplicity has been studied in the arrangement of the different working parts, which are put together as follows:—The bottom-valve seat being wound with tow-yarn, sail-cloth, or other suitable material, is forced into its socket at the bottom of the casting; the butterfly-valves are then fixed by hand. The expresser, connector, &c., complete as in fig. 4, are then dropped into the fountain. The brass flanch rims in this figure resting upon a collar of leather, placed upon the internal projecting flanch of the fountain (a screw-bolt, as seen in fig. 4, being turned a few threads), fixes the brass rims tight in the casting. Or a more ready and better, but more expensive plan, is to keep those rims pressed down by a hollow zinc weight, in the bottom of which holes are cast at equal distances apart to receive the screw-heads projecting from the top surface of the rims. A perspective section of this weight is seen in fig. 1, a little removed from its intended bearing. Thus all the works being within hand reach, they can be examined and replaced in less time than Jack can box the compass, and yet may go for years without requiring attention.

To comprehend the action of the connector or flexible cone of leather, the reader must observe, on the rod being raised it causes the connector to roll all round from off the supporting cone, beginning at its smaller circumference; it is then received and sustained by the lower conical length of the expresser, when the entire stroke is made. The connector as transferred to the expresser, is shown in fig. 4; in this figure the valves are seen beginning to open for the return or downward stroke. The connector is then conveyed *vice versa* in the same easy and firm reciprocating rolling action to the supporting cone, thus avoiding both leakage and friction; and in practice, the evolutions of the connectors is found to throw off any particles that might be thought likely to choke or impede its action.

The first fountain-pump ever placed on ship-board was a power No. 10. This I fixed alongside a common pump in the Spring, 100 tons burthen, near seven years since, she being the first vessel built at Norwich; William Brook, the captain, declares the fountain-pump has twice saved the vessel and crew: its fourth connector is now in action.

The average diameters of the cones in this power being 7·81 inches, with a dip of 7½ inches, gives nearly 13lbs. of fresh water per stroke. A man of ordinary strength can with ease maintain a barrel of salt water per minute for a long spell, and can raise two barrels per minute for a few minutes in succession when lifting the water 16 to 18 feet high; and as there would require three relays of men to work with full effect constantly night and day two such fountain-pumps, it is presumed, would be sufficient duty for all the hands that could be spared in any emergency from the crew of a 300 tons' vessel. In passenger vessels of this class larger powers would certainly be preferable; but as this would add to the expense in the first outfit, that reason will generally prevent any shipowner erring on the safe side, especially whilst that system of marine insurance of which Capt. Ballingall so loudly complains is continued. In vessels of easier draught a boy can work power No. 10; so that where a crew value their lives, I consider smaller powers ought not to be introduced, although the average of common pumps in these vessels are not capable of delivering above one-third the quantity of water.

WILLIAM SHALDERS, Jun.

LIFE-ANNUITY SCALES.

In the notice which the Editor of the *Mechanics' Magazine* was pleased to take (vol. xvii. p. 9) of the pocket-rule which bears my name, allusion was made to the fact, that the scales of life-annuities were not laid down from any published tables, and a hint was given that the principle of their construction ought to be explained. Of the propriety of this I had been perfectly aware, and it was my intention to have fully developed the basis on which my modification of the Carlisle tables was founded. My intention was changed by the appearance shortly afterwards of a valuable set of tables,[*] founded on the same principle as my own calculations.

Having it, then, in my power to refer to a published work in explanation of the basis of my life-annuity scales, a much more concise development of it here will suffice.

The discovery separately made by Mr. Edmonds and myself consists in this:—1st, that the most simple function of the law of mortality is that which expresses *the probability that a life of any given age will live to the end of a year*, or other small definite period; and, 2d, that *the values of this function*, for regular intervals of age, *are in geometrical progression*. Mr. Edmonds states, that "there are three distinct orders of progression, corresponding to three remarkable periods of animal life—infancy, manhood, and old age." Each of these periods has its own geometric series; and the three "are so connected, that the last term of one series is the first of the succeeding series." The "law of mortality" is thus represented "by the ordinates of three contiguous segments of logarithmic curves."

The limit between the 2d and 3d of the above periods, Mr. Edmonds fixes at the age of 55; but he admits that it is subject to a small fluctuation. As my inquiries were limited to the finding of a regular curve, the ordinates of which might be with propriety substituted for those deduced from the very irregular numbers published by Mr. Milne, I was led to fix on the age of 60 as the commencement of the third period; but upon a comparison of my calculations with those of Mr. Edmonds, I find that the epoch might have been carried back to 55, with an insensible difference in the practical results. And, in fact, the tables printed by Mr. Edmonds, founded on what he calls "village mortality," differ throughout so little from that which I computed for laying down my rule, that either might indifferently have been used for that purpose.

J. W. WOOLLGAR.[*]

SOAP FROM FLINTS.

Wonders will never cease. This Magazine has been the medium of communicating to the public many curious and useful inventions; but making soap from flints we little thought it would have fallen to our lot to mention on this side of the grave. Mr. J. C. C. Sheridan, a native of Belgium, is the inventor of the process, and has obtained for it patents in England, Scotland, and Ireland. It is very agreeable to us to be the first to describe to the public a process so likely to produce a total but highly beneficial revolution in the manufacture of soap. Mr. Sheridan takes the common black flint, calcined, and reduces it to powder by wet-grinding; then mixes it with the caustic soda leys, or potash leys, and boils it till it attains saponification. The mixture so obtained is added to the present soap materials after the latter have been boiled to that state when they have become soap, and are ready to be poured into the frames. The mixture, which has a highly detergent quality, requires to be well crutched along with the soap materials; and when thus crutched together, the result is a soap of excellent quality.

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[*] Life Tables, founded upon the Discovery of a Numerical Law, regulating the Existence of every *Human Being.* By T. R. Edmonds, B.A. London, *1832.*

[*] Mr. Woollgar's signature should have been appended to the article on "Henshall's Sliding-Rule," in our last Number.

The mixture becomes intimately incorporated with the soap materials, and may be added in the proportion of from 40 to 50 parts of the mixture to 50 of the soap materials. Thus the common silex, which is obtainable at a very low price, takes the place of tallow, not purchasable under 40*l*. per ton, to the extent of nearly one-half. This invention, which promises to come into very general use, will have the effect of diminishing the consumption of tallow, and consequently rendering us, in the production of a staple commodity of the utmost importance to health and commerce, independent of the great northern Autocrat.

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PROCEEDINGS UNDER THE LATE PATENT LAW AMENDMENT ACT.

Mr. Wells and the Sea-Water Purifying Company.

In some former Numbers the attention of our readers was drawn to the *nature* of the invention in the patent claimed by Mr. Wells, and which (if report be true) he had induced the above-named company to adopt upon payment to him of some thousands. Luckily for the shareholders, our taking up the subject induced *some* of the Directors to make inquiries *themselves* into the patent, and they discovered that the *novelty* claimed in it had been invented one hundred and sixty years ago, and that it had been also patented thirty years ago. However, as "drowning men will catch at straws," so Mr. Wells thought he would try and get his patent *confirmed* under the new Act, and he petitioned the Privy Council for that purpose. The case was heard before their Lordships on Saturday, the 3rd instant.

It is the first application which has been opposed; which circumstance, together with the opinions of Lords Lyndhurst and Wynford on the construction of the Act, render the case of some importance.

The patent which was sought to be confirmed was one taken out by Messrs. Westrup and Gibbins for a mode of purifying salt water. Mr. Wells was the assignee of the patentees, one of whom, Westrup, is now dead. It was therefore *impossible for the petitioner* to make out *even a full prima facie* case, as the Act requires that it shall be proved to the satisfaction of the Privy Council, that the patentee "believed himself to be the original inventor;" and we know not how any one could witness as to the belief of a deceased person.

The point of the patent, which was found not to be new, was the method of condensing the steam raised from the salt water, by bringing the pipe or worm through which the vapour passed into immediate contact with the cold sea, by passing it over the bow of the vessel, or through a worm-tub containing water, flowing immediately from the sea through an inlet and outlet in the side of the vessel.

The opposition to the confirmation of the patent rested on the three following grounds. 1st. That the same plan had been described in "Hales's Experimental Philosophy," published one hundred and sixty years ago. 2nd. That it had been patented in 1806 by one John Lamb, probably (as Sir F. Pollock, counsel for the opposition, observed,) the physician of that name who undertook to cure all diseases with water; and, 3rd. that it had been in 1809 again patented by Mr. William Archbold, better known for his legal than mechanical labours.

The petitioner's Counsel (Mr. Rotch) argued, that as these patentees had allowed their inventions to lie dormant, and had never brought them "into public and general use," therefore he contended, that as Mr. Wells had brought his patent into general use, the prayer of the petitioner should be complied with.

Lord Lyndhurst—The Act was never intended to apply to a case where patentees choose to shut their eyes, and when they might have gone to the Patent-office and seen these specifications at once. It never could be intended, that a subsequent patentee should have a right to come to the Court, to apply to have the exclusive benefit of an invention, adversely to the rights and interests of the former patentee, or original inventor. The Act was certainly meant to apply to a very different case.

Lord Wynford—The object of the Act was, that if there should happen to be any *very minute* portion of an invention which had been used, and the patentee swears he did not know it, in that case the Court is authorised to confirm it.

Lord Lyndhurst—The party ought to have applied to the Attorney-General to allow a disclaimer to be entered of such part of the patent as was discovered not to be new, under the first section of the Act.

Mr. Rotch said, that the Act opened two doors to the patentee; either he may disclaim the old part, or petition to get his right to it confirmed. In the present case, he had thought the latter course most advantageous to his client.

The Council, after some discussion upon the construction of the Act, in which the Attorney-General, who happened to be present, joined, refused to confirm the patent.

On Sir F. Pollock applying on the part of the objectors for costs, Lord Lyndhurst said, that as the petitioner had been supplied with a copy of the objections upon which the opposition to the confirmation was grounded, and as he had after that thought proper to proceed with his application, he must take the consequences. If a party entitled to oppose, does oppose, and opposes successfully, if the Court does not give him his costs, it would discourage persons from coming forward to protect the interests of the public. His Lordship said he was decidedly of opinion that this application was an experiment to see how far the Court would go. He knew that the noble and learned Lord, who was the patron of this Act, and under whose particular direction it was drawn, never meant that a loose construction should be given to it. To bring a case within the Act, so as to justify the interposition of the Judicial Committee, he considered the petitioner must make out some *special* and *strong* case.

The petition was dismissed with costs.

And so it has come to pass, that Mr. Wells and his patent have been thrown *overboard* with his *pipe over the bow* to cool and refrigerate. The Company have had a narrow escape; we warned them of their danger, and we take to ourselves some credit for drawing the attention of the public to the subject, and are glad to find that it was not lost upon those of the Directors who have acted honourably and perseveringly to prevent the money of the shareholders from being paid for the patent of the Secretary, which is thus proved to be good for nothing.

COURT OF COMMON PLEAS, GUILDHALL, 25TH FEB., 1836.

Before Lord Chief Justice Tindal, and a Special Jury.

MACINTOSH v. EVERINGTON.

(Continued from p. 480.)

John Thomas Cooper, Esq., cross-examined by Mr. Serjeant Wilde.

I put in India-rubber in the proportion of eight ounces to the gallon of the crude oil, and ten ounces to a gallon of Cassell's; and the result of my experiment was, that this oil skimmed from the surface produced an article not equally pure, but fit for the purpose, except, as I have mentioned before, that the article is more stiff; and, I might have added, there is always an unpleasant smell from the crude oil which the other very soon loses, while that with the crude oil retains it—it is not gone yet, and it has scented all the others that have been wrapped up with it. I hold in my hand a solution of the India-rubber in crude oil; in order to obtain that solution, I merely shred the India-rubber into small shreds, as thin as I could cut it, and then digested it in the oil with the assistance of a little heat, putting it into a vessel of water, and keeping the water warm, and stirring it. As far as I can judge, both the solutions were accomplished in the same time, and in the same form and manner. This piece of cloth was merely pressed with a smoothing-iron; the cloth was not supplied to me for the purpose; my wife purchased it at a shop in the neighbourhood; I beg pardon, it was a pupil.

Mr. Lowe, examined by Mr. Watson.

I am a Fellow of the Royal Society, and for the last fourteen or fifteen years engineer of the Chartered Gas Company. Coal-oil is produced in making coal-gas; it floats on the surface of the ammoniacal liquor, but a greater quantity is produced later in the process. It must be previously understood there is a very considerable difference whether we are using Cannel coal, Newcastle coal, or a less bituminous coal, the coal of the Midland counties; the Cannel coal produces the greatest quantity of coal-oil. This is a specimen of the coal-oil as produced in the Chartered Company's Works at Brick-lane station; and in one vessel, which is called the gas-meter, I find at this time there cannot be less than 100 or 150 gallons of volatile-oil, such as this is. This specimen was obtained from pumping some of the syphons of the establishment beyond the meter where the gas passes into the gas-holders. I dissolved India-rubber with that coal-oil, and this is the result. In the year 1823 this substance was called coal-oil, volatile-oil, and spirits of tar; it had various names; it was known as coal-oil then, but of late years more as naptha.

Cross-examined by Mr. Serjeant Talfourd.

A much greater proportion of this coal-oil can be obtained in gas-works according to the circumstances under which they conduct the process called condensing, or cooling, or refrigerating the gasses. If you let the whole of the products of condensing go together with that which is condensed in a high temperature, and that which is condensed on a much lower temperature, you will see but little of this coal-oil, and it will be a general mass of coal-tar: to separate these, it must undergo the process of distillation; but from the mode of cooling the gas, which is often rather differently done, then you may separate them in a much higher ratio.

Re-examined by the Attorney-General.

Independently of any peculiar means used for condensation, there has always been a considerable product of the coal-oil in the gas-works since I have known them; independently of the coal-oil which may be in combination with the tar. We use Newcastle coal. I think we could supply from our works alone of this coal-oil which is separated in the first instance, independent of that which is in combination with the tar, 7 or 800 gallons weekly. I think there are eight or nine other establishments in London. I should say the supply altogether, speaking within moderate bounds, would be from all at least 3,000 gallons a week of the coal-oil, from the first distillation of the coal.

Alexander Garden, examined by the Attorney-General.

I am a practical chemist, carrying on business in Oxford-street. I have read the specification of Macintosh's patent, and think there can be no difficulty in making the fabric from the directions there given. I never heard of a similar process before that patent. I have myself made some experiments in accordance to the specification described by Mr. Macintosh in his patent, and applied the solved caoutchouc to some fabrics, which made them impervious to water. I employed two kinds of coal-oil—one I obtained from Mr. Cassell's, and the other, I think, was sent to me by Mr. Blunt. I know what coal-oil is perfectly well; I have known it many years, ever since the introduction of gas; it is obtained in the distillation of coal, and commonly called coal-oil, and known by that name. These specimens are water-proof, and cemented together by means of the dissolved caoutchouc. I have got some specimens of the cement here, which I made myself from the coal-oil and the India-rubber, about the consistence of honey; I put it on with a common painting-brush. I have made some experiments upon what is called Clarke's process; I prepared some agreeably to it, but I have not been successful. I pursued exactly the directions given; I tried as sincerely to follow that as I did Mr. Macintosh's; I had no intention to do otherwise, I did my best to ascertain the result. The linseed-oil and caoutchouc form a compound something like bird-lime. With regard to Macintosh's, when the coal-oil is evaporated the India-rubber remains in its original form, and with its original properties. I have not tried what is called Weisse's process; it appeared to me there was no chance of succeeding in it, therefore I did not attempt it. From the description of Weisse's, it is not at all like Macintosh's, totally different. I received from Mr. White, who has been examined here, a piece of the cloak which he bought at Messrs. Everington and Ellis's, and analysed it. It is not made according to Clarke's process, nor according to Weisse's, but I should say according to Macintosh's; I have no doubt about it. I obtained elastic gum from it with quite the same properties as that which Macintosh does by digesting caoutchouc in coal-oil. I put the cloth into a bottle with some coal-oil, and digested it in that for some time; and I found that I obtained a solution of India-rubber, which I procured by evaporating the coal-oil, and I got India-rubber as the residuum. I know the coal-oil in what is called its crude form, as it is found after the distillation of the coal. I saw it, as I mentioned, at the time gas-light was first introduced; I received the products from Mr. Winsor, who was the introducer of gas. I have made experiments with coal-oil in its original form in dissolving India-rubber, and it answered equally well.

Cross-examined by Mr. Rotch.

The specification directs that the substances that are to be united be stretched on frames before put together. I found nothing in my analysis of the piece of cloak that told me any thing about the frames; that was impossible for me to tell. I could only tell by my analysis that it had India-rubber in its composition; and finding it interposed between the two pieces of cloth, it appeared to me to resemble that of Mr. Macintosh. The solution with crude oil, when I had mixed the India-rubber with it, I put through a fine wire-sieve, in the same manner as the other; and the mixture was entirely free from any granulated particles, and perfectly smooth, scarcely any thing remained. I put that solution also on with a brush in the same manner exactly; it was cold when I put it on. I think that it might be divested of a great deal of its smell; if it was exposed to heat it would dry, and the smell would go off. I do not know that the crude oil has been considered unfit for use without being rectified; on the contrary, it answers the purpose of dissolving, and renders the cloth waterproof, but when rectified it will be, no doubt, infinitely better. When I saw his patent, I should not have known whether it was crude oil or rectified oil that was to be used, only he speaks of various degrees of purity, therefore I should presume the oil was made as pure as possible. If he had particularly specified crude oil, I should naturally have used crude oil.

Re-examined by the Attorney-General.

The cloth manufactured from what is called the oil in its crude state is quite impervious to water, and I should expect therefore that it would be impervious to air. I think it might be cleared or freed from that smell; but with that smell it might be usefully employed in covering carts and for other purposes. If it were put in a room heated from 100 to 140 degrees, I think that probably would rid it of the disagreeable effluvia, or a great deal of it. This substance, before it has been re-distilled, and after it has been redistilled, is still called coal-oil.

Dr. Turner examined.

I am a Professor of Chemistry at the London University, and Fellow of the Royal Society; I am acquainted with Mr. Macintosh's patent and the specification; I knew of the invention at the time it was first made publicin 1823; I was residing in Edinburgh when I heard of it; in my opinion it was at that time new. I have not minutely attended to manufacturing chemistry, but I scarcely think it could have been a discovery of any importance without my knowing it. I am acquainted with the manufacture of coal-gas in a general way, and I have visited many gas manufactories; I have known coal-oil for a number of years; I have known the nature of the substance ever since I have known the nature of coal-gas; I became familiar to some extent with such subjects about 1823. I should conceive those persons well acquainted with the subject, must be acquainted with the substance called coal-oil. The mineral naptha and coal-oil I conceive chemically to be different substances; the mineral naptha is a substance which properly has the term naptha applied to it. I have gone through the processes of Mr. Macintosh, not minutely, but in a general way, and the specification appears to me to properly describe the process.

Mr. Arthur Aiken, examined by Mr. Serjeant Bompas.

I am the Secretary of the Society of Arts; I remember the time when Macintosh's patent first came out. About the time, as far as I can recollect, the patent was taken out, I had the pleasure of seeing Mr. Macintosh at a Chemical Club, which met in London, and he was introduced to that club, I think, as far as I recollect, by Dr. Wollaston; and at that time specimens were handed to us as being a new article; according to my judgment it was at that time a new invention; I never heard of any thing similar to it before; I know the substance called coal-oil; it is one of the products in the manufacture of coal-gas; if it is wished to be made pure, the common mode of purifying a substance of that kind would be by distillation. I have devoted some attention to India-rubber, and have occasionally made experiments upon it. The temperature of boiling oil is so near that in which India-rubber itself undergoes decomposition, that I should expect if India-rubber were put into it, it would be blackened and more or less decomposed.

Mr. James Bowman Neilson, examined by Mr. Watson.

I have been Manager of the Glasgow Gas-works eighteen or nineteen years; we burn entirely Cannel coal; in making the gas we have deposits of tar, ammoniacal-water, and coal-oil; all these substances are separate and distinct; I find the coal-oil in what I call the tar-pit, also in the condenser, and in the mains in the street; I find it also on the surface of the ammoniacal liquor. The first person that obtained it from the Glasgow works was Mr. Macintosh, about the year 1819 or 1820; he continued taking it till about six years ago; before that time a Mr. Thompson took the tar of us for the purpose of making mineral paints. Before Mr. Macintosh got it, we were obliged to dispose of it as we best could; to treat it as refuse; it was carted out into the country some miles, and put upon the land. Since Mr. Macintosh has discontinued taking the coal-tar, we have used it for fuel; Mr. Macintosh has taken the ammoniacal-water and the coal-oil since—all that was produced—a very considerable quantity. The quantity of the ammoniacal-water we get in the course of a year would be about 230,000 gallons, and of oil, I believe I should say, upwards of 6,000 gallons. I have tried it in the crude state, before distillation, as to its effect on India-rubber; I merely did so for the purpose of satisfying myself, that the coal-oil in a crude state before distillation would dissolve India-rubber. I have seen Mr. Macintosh's specification.

Cross-examined by Mr. Serjeant Wilde.

I am the Manager of the Gas-works. The products were pumped off from the receptacle where they were collected, and I always found the tar was pumped first, the ammoniacal liquid was next, and the coal-oil was pumped last: these oils were put into one vessel just as they were pumped. Since the alteration he has taken the product of the coal, with the exception of the tar, in the same way. I form my judgment as to the quantity of coal-oil, as compared with the quantity of ammoniacal liquor, by the eye. I have sent hundreds of gallons from one of our gas-holders; I measure the quantity of gas that I give out per twenty-four hours; the average quantity throughout the year, I make about 25,000 cubic feet in an hour in the winter, and about 10,000 to 12,000 in the summer, that is at one set of works; I never separated any of the coal-oil, it separates itself; I only sent it once in a separate vessel; it was of a yellowish colour—a yellow brown.

Re-examined by Mr. Attorney-General.

The oil and the ammoniacal liquid were entirely separate products; they separate themselves so that they might have been kept apart without difficulty; the oil could have been taken from the surface of the ammoniacal liquor, and put into a separate vessel if that had been wished to have been done. We can draw away the liquor and allow the oil to remain, and we can draw away the tar and allow the ammoniacal liquor to remain. First the tar, then the ammoniacal liquor, and then the oil, all right well. This substance which floats on the top of the ammoniacal liquor goes by the name of coal-oil.

Mr. Ewart, examined by Mr. Attorney-General.

I am now chief Engineer and Inspector of Machinery to the Admiralty. I have had occasion to see how Mr. Macintosh's manufactory was conducted in making of water-proof cloth; it began in 1823; I directed the construction of the machinery; I was about to be engaged or concerned in trade with Mr. Macintosh at that time; I know the specification, and the manufacture was carried on according to that specification in Manchester. It was laid on by a brush; the brushes were worked by machinery instead of by hand; I continued to see how it was done till 1826; I have seen the cloth so manufactured tested, and tested it myself very often, and it was water-proof and air-proof; it was equally air and water-proof before the machinery was applied; I was there when the brush was worked by the hand; there was no difference in the production, whether worked by the hand, or worked by power.

Cross-examined by Mr. Serjeant Wilde.

I am speaking of that branch of the manufacture which relates to laying of the solution on the cloth; the solution came from Glasgow ready prepared; I was there at the time of discontinuing the brush with the hand, and using the brush attached to the machinery; when the brush was applied by machinery, there was a trough attached to the machine.

George Palmer, examined by the Attorney-General.

I am the Manager of the Metropolitan Gas-Works. We use Cannel coal, which produces an article called coal-oil. This oil has always combined with it a certain portion of tar. The proportion of coal-oil that can be separately drawn off is about 2½ gallons to each 10,000 cubic feet of gas. It can be drawn off without difficulty, being specifically lighter than the tar and liquor, &c., and floats on the surface. This specimen has not been re-distilled. Sometimes the oil taken immediately from the gas-main is nearly as good as that re-distilled. We have not been in the habit of selling the coal-oil in a separate state, it is sold with the tar; but the price is increased which is given for the tar in proportion to the quantity of materials it contains. The first experiments made to ascertain the quantity of this coal-oil was, to my knowledge, in 1829, when the public were made fully acquainted with it by a work which was published by Mr. Attwood. The specimens of coal-oil produced are obtained in the common manufacture of gas.

Dr. Fitton, examined by the Attorney-General.

I am a physician, and have attended to philosophical and scientific pursuits. I am acquainted with Mr. Macintosh's patent. I have not attended to chemistry for many years, but I have been a member of the Chemical Club, where this subject was mentioned, I think, about the latter end of 1823 and 1824. Dr. Wollaston was a member of that club. I had there an opportunity of hearing a great deal about Mr. Macintosh's patent. From what I heard then and since, I believe it to be new.

Mr. Children, examined by the Attorney-General.

I am Secretary of the Royal Society. I am acquainted with Mr. Macintosh's process for making cloth water-proof and air-tight. As far as my knowledge goes, when it was introduced it was perfectly new.

Cross-examined by Mr. Serjeant Wilde.

I have never heard of India-rubber being applied to any fabric to render it water-proof in the way applied by Mr. Macintosh.

The Attorney-General.—That is the plaintiff's case, my Lord.

Mr. Serjeant Wilde.—This is undoubtedly an important cause both to the plaintiff and the defendant, as well as to the public. My friend on the part of the plaintiff states, that Mr. Macintosh having been at the labour and pains of discovering an invention of great value, there ought to be preserved to him a remuneration adequate to that labour by an exclusive sale of the article; and I agree that in a case where an individual has by great labour, or even by accident, actually been the discoverer of some useful invention, by which the public are to be benefitted, he should be entitled, according to law, to the exclusive sale of the article patented; but, on the other side, and on behalf of the trade in general and of the public, I claim that an individual shall not, when the subject is generally before the public, step in and by an uncertain, vague description, lay his hand upon some useful manufacture, reserving to himself not something he has discovered, but something which he hopes either he or some other person will discover, and which when discovered shall refer back to his patent. My learned friend, on the part of this plaintiff, says, various persons had been engaged in trying to accomplish the object of procuring water-proof garments sufficiently light and flexible to be useful. The public were within a step of accomplishing this object; Mr. Macintosh, fortunately, advanced that step first. It is my case that he did not; that this is one of the many patents, which, when the attention of the public is flat, a man, by some means, gets, and seeks to maintain afterwards, by subsequent invention and discovery, he having little more knowledge, if any more, than the rest of the public at the time he gets it. It has been known for years before the patent, that India-rubber might be applied so as to render a fabric water-proof; and if this India-rubber is applied on the outside it will be inconvenient, have a clammy appearance, be disagreeable, and want renewing. If in the inside, it will be still more disagreeable, being next the person. "Oh, but," says Mr. Macintosh, "I will put a lining, and then I will get a patent." The solution that would render it water-proof is perfectly well known. In the specification he says, "I don't claim the solution, but I claim putting two fabrics together, and as they are wanted to stick, I shall press them." You don't want a patent for that; and this patent has no other object than putting two *pieces of cloth together* with *a well-known solution of India-rubber* between. To express it in the language of the Vice-Chancellor, he has got a patent for a sandwich—he has put two things together, and got a patent for it. Now, I say, that the circumstance of his applying a known solution to a known purpose to produce a known result, clapping one piece of cloth over another—cannot be the subject of a legal patent. I shall read you the specification of a man of the name of Johnson, who got a patent years ago for using a solution of India-rubber for cloth; he says, "take flock, such as you put on the paper of a room, and make a lining of that." This plaintiff says, "I will put a piece of cloth instead; and all these gentlemen from the club, by which our brains have been attempted to be knocked out, say, "We never heard of such a thing before," that is to say, they have not been attending to the matter. The defendants are not manufacturers, but deal largely in all articles of dress, and are glad to sell that for which there is the most demand. The only evidence of the infringement is, that certain parties have effected the same object as the patentee, and the witnesses know of no other means than those which the patentees use to effect that object. When Mr. Macintosh comes, on the ground of his having advanced only one step before the public, and claims to retain to himself the exclusive right to sell this article, he is bound to make out a perfect and a strict case. When the Crown grants the exclusive right, it is granted upon certain conditions; and one express condition is, that the grantee shall, in consideration of the grant of the Crown for fourteen years, give the public the means of using that invention after the expiration of his patent in the best manner that he can inform them. There is a class of patents which ought to be narrowly watched—in which there is a vagueness and generality in the specification, partaking of that quality which my friend has ascribed to some of the specimens of bird-lime, catching all that comes within its grasp; and there is in this case an intended vagueness and generality, in order to cover any thing which might by Mr. M. or any body else be discovered thereafter. My learned friend says I claim for Mr. Macintosh the exclusive right of selling a coat formed of two pieces of cloth stuck together by an India-rubber cement; I say the patent was intended to claim more than that, not only fabrics stuck together by India-rubber cement in a state of solution, but cloths stuck together by any flexible cement, not limited to India-rubber. Mr. Macintosh claims no right whatever in regard to the solution, except its application to the two pieces of fabric which are to be stuck together. He gives you in the specification the solution that is to be used; he tells you that is the best mode he has found out, and if that is untrue, he is not entitled to exclude the rest of the trade from participating with him. I will read you the specification, calling to your attention two points; first, whether it claims the putting two pieces of cloth together by means of any flexible cement, or by means of a flexible cement of India-rubber in a state of solution, only? And the second point is, what is the solution which Mr. Macintosh affects to tell you is the one that ought to be used to produce the desired effect? Mr. Macintosh says, "In compliance with the said proviso, I do hereby declare that my said invention doth consist in a manufacture of two or more pieces of linen, woollen, cotton, silk, leather, or paper, or other the like substances; any or either, or combination of any or either of the same, cemented together by means of a flexible cement." This passage amounts to this,—I claim putting two pieces of cloth together by a cement—that is the substance of it—"the nature of which said manufacture is, that it is impervious to water and air." I should be glad to know what you find about India-rubber there. There is but one object in the paragraph which I have read, and that object is to state what his invention is, and in it there is not one statement about India-rubber. What possible cement could have been used that would not have fallen within it?—None. Any flexible cement for the purpose of uniting two pieces of cloth together, and rendering them waterproof and air-proof, would be within this patent. He proceeds—"In further compliance with the patent, I hereby describe the process which I have found the best for performing the said manufacture." If I prove that Mr. Macintosh knew a better mode of performing his invention, that he used a better, that he never used the one described, then I shall prove an utter failure in the performance of his condition. In order to decide whether this was a *bonâ fide* disclosure, I questioned witnesses to ascertain how Mr. Macintosh did it, but was stopped. Mr. Macintosh has no new patent for any improvement; he manufactured this solution before 1823; he continues to manufacture it since 1823, and up to the present hour, and we are to discuss whether he has disclosed the most useful mode of preparing it, which he was apprised of at the time, and for that purpose I was entitled to know how he now carried on the manufacture. He says, "I prepare caoutchouc by cutting it into very thin shreds or parings, and then steep it in the substance which is produced in making coal-gas, commonly called coal-oil; the quality of these ingredients is extremely various." That is, the quality of the substance produced in making coal-oil; *some part of it is found* in main, that is a *certain degree of purity*; other parts are *found in the condenser*, that is of a certain degree of purity and impurity; other parts are found pure, and therefore all varying in purity, according, apparently, to the degree of distance to which its volatility has tended to carry it, "and the relative proportions to be employed must depend on the quality of each; but when the caoutchouc is of the best quality, and the oil pure, from ten to twelve ounces of the former to a wine-gallon of the latter will be found to answer." Now this is the best mode that Mr. Macintosh has found of dissolving the caoutchouc or India-rubber. "This infusion I submit to a gentle heat obtained from a water or steam-bath, and I employ constant trituration until such time as the ingredients are reduced to a thin pulpy mass; when to render the whole as homogeneous as possible, I pass it through a very fine wire or silk sieve or searce, and if this part of the process has been duly followed out, the varnish will then be without any granular particles, and will, in appearance, resemble thin transparent honey; fabrics or substances effectually united by cement thus prepared in whatever way the union is effected, become both air and water-proof; but with a view to prevent the cement from appearing upon the surface of the manufactured articles, and to insure, at the same time, a perfect union of the substances, I, in the first place, distend the substances to be united, and with a brush or other suitable instrument, lay upon the surface of each an uniform layer or coating of the varnish or cement; and when this coating has, from evaporation of the oil, which is extremely volatile, acquired a clammy viscous consistency, and this will take place in a shorter or a longer space, in proportion to the heat of the atmosphere, and the current of air in which the manufacture is carried on, or to which the coated surfaces may be exposed, I apply the varnished side of both substances to each other, and, by means of a calender or rollers, or other suitable means, I powerfully press the fabrics or substances together, whereby they become united, and are rendered a compound fabric or substance; and thereafter I expose this compound fabric or substance in a stove-room, or other suitable place, to a heat of from 100 to 140 degrees, for the double purpose of maturing the manufacture and obtaining a further evaporation of the oil, which, while it remains, gives off a disagreeable effluvium. When the substances to be united are of an open texture, or not of a smooth uniform surface, I apply a greater number of coatings of the cement or varnish, and when three or more fabrics or substances are to be united together, I coat with the varnish the substance or substances to be enclosed on both sides, and complete the process as before suggested; farther it may, in some cases, be sufficient to apply the layer or coating, or coatings of the varnish, upon one side only of one of the fabrics or substances, applying the other fabric or substance uncoated upon the clammy viscous surface of that which has received one or more coatings of the varnish, and then complete the process as before suggested." The substance of all this is, put on the cement with a brush, sometimes on one cloth, sometimes on both; these are put together, and pressed together, with a certain degree of heat. But I would call your attention to the description of the solution which is to be used, in connexion with another part of the specification which applies still closer to that part of the invention. "Now, whereas caoutchouc, in a state of solution, and dissolved in manner hereinbefore described, is well known to chemists and others, and not new, therefore I do not claim any right, title, or privilege, in respect of the same; but a manufacture of two or more pieces of linen, woollen, cotton, silk, leather, or paper, or other the like substance, any or either, or any combination of any or either the same, cemented together by means of flexible cement in manner hereinbefore described."—Mr. Macintosh says, I claim the produce of certain results—the union of two fabrics together by a cement, rendering it impervious to air and water; there are various modes of doing it; I will tell you one: he disclaims being the inventor of the solution; he only tells you the mode he has found the best; it is by a solution of India-rubber; but does he confine his invention to the cement by means of that solution? I submit he does not. I ask you if a man shall find any other solution, or had found any other flexible cement, by which he had united two fabrics together, and rendered them impervious to air and water; I ask whether Mr. Macintosh would not have had a much stronger argument to come forward, and say, my claim was expressed in the most distinct terms—the union of two fabrics by any flexible cement; you are unjust, you are applying critical acumen, you are improperly depriving me of the benefit of my patent, because I give you one species of cement which will accomplish it, and you seek to limit me to that one, though I told you it was not the only one, but the one which, according to my experience, I found the best? But to-day he cuts down his specification to the particular instance which is given as the best, and says—by flexible cement I do not mean any flexible cement, but only India-rubber. As far as my intellect goes, I cannot entertain a doubt but that this was intended to apply to any flexible cement; at least, it is very ambiguous; at least it would have been open to Mr. Macintosh to have contended *with an equal chance* of success the one way as the other, and I shall therefore pray my Lords' judgment; first, whether this is not a claim to the extent which I have mentioned in the specification; and next, whether at least it is not so ambiguous and doubtful, so disingenuous in the mode of doing it, so uncertain in what he claims, as to be void. That is my first objection. Mr. Macintosh has claimed more than he is entitled to; he has claimed for all flexible cement, and he now shrinks from that because he knows he cannot sustain his patent to that extent; but his specification is against him in this; and if it is ambiguous and doubtful, it is equally objectionable. My next applies to Mr. Macintosh's conduct, in regard to the solution. He brings forward scientific witnesses upon this point—and I will say a few words on the value of scientific evidence. There was an action brought on a policy of insurance, and the question was, whether a sugar-baker who had altered his mode of boiling sugar, by boiling it with oil instead of steam, had adopted a more dangerous mode than that which he used at the time of the insurance, because if he had, the insurance was void. Sixteen witnesses for the plaintiff swore all their experiments proved decisively that the boiling by oil was less dangerous than boiling by steam; sixteen witnesses for the defendant were perfectly satisfied, and their experiments proved their accuracy, that the boiling by oil was much more dangerous than steam; on which my Lord Chief Justice Dallas said, "A melancholy day this for science and scientific men." Another unfortunate instance we have in the case of Eliza Fenning, against whom the scientific men gave evidence that arsenic in pudding would turn a knife black, and it was upon that evidence she was found guilty; it turned out that it would not do it, but that an onion would!

(*To be continued.*)

TAIT'S GASOMETER.

Sir,—I perceive that your correspondent "*Clovis*," repudiates his identity with Mr. Stephen Hutchison. Why then continue to wear a mask?—there may be occasions on which a mask may be allowed; but this, most assuredly, is not one of them. Assertions have been made as to the failure of my gasometer, by "the unskilful and unscientific application of the hydraulic-joint," which I have impugned as being untrue in point of fact. An opportunity has been offered (in *Mech. Mag.*, No. 655, p. 443,) to your correspondent, to adduce his justification and authority for making such assertions. He has, however, allowed the opportunity, thus offered to him, to pass; and, instead of attempting to adduce any authority, he has repeated his calumnies.

"Let me know" (he says), "the *time and place, when and where* your gasometer may have been, or is still to be, seen in actual operation:"—"Give me *ocular proof*, and *then* I will tell you *when* and *where* your gasometers failed!" Now, all this I call exceedingly modest; your readers must be struck with its propriety. He does not know *when and where* my gasometers were erected; but he will feel obliged to me *to let him know!*—and having obtained this very necessary preliminary intelligence, he will *then*, no doubt, be in a condition (but not till then) to afford me the information required in my letter in *Mech. Mag.* for 27th Feb. p. 443, as to the "time, circumstance, and place," where my gasometers had been "*abundantly tried;*" but that owing to my "unskilful and unscientific application of the hydraulic-joint, I had the pain of witnessing their complete failure!"

This is positively too ridiculous. I have neither inclination nor time to occupy with such a *Homo*. The only favour I should ask of him is, that he will not do me the injury to praise me. I have just another remark to make, and then I have done with him.—In your Magazine for 20th of Feb. last, p. 413, he refers to a gasometer at Leeds, as an instance of the failure of my gasometer. This turns out to have been rather an unfortunate assertion of your correspondent "Clovis:" seeing that at the very time when he referred to this gasometer, as *mine*, he was fully aware (see *Mechanics' Magazine* of 5th March, p. 455), that it was both designed and erected by Mr. Hurst! I cannot, after all this, condescend to notice any further effusions of Clovis's.

I am, Sir, &c.
W. TAIT.

March 8, 1836.

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NOTES AND NOTICES.

Preservation of Animal Matter.—At a late meeting of the Asiatic Society, a human hand, and a piece of beef, preserved by means of a preparation of vegetable tar, found on the borders of the Red Sea, in the vicinity of Mocha, and a specimen of the tar, were presented by Lieutenant-Colonel Bagnold. In an accompanying letter Colonel Bagnold observed—"During my residence as Political Agent on the Red Sea, a conversation with some Bedouin Arabs, in the vicinity of Mocha, led me to suspect that the principal ingredient used by the ancient Egyptians in the formation of mummies was nothing more than the vegetable tar of these countries, called by the Arabs *katruan*. My first trials were on fowls and legs of mutton, and which, though in the month of July, and the thermometer ranging 94° in the shade, succeeded so much to my satisfaction, that I forwarded some to England; and have now the pleasure to send, for the Society's information and inspection, a human hand, prepared four years ago by my brother, Captain Thomas Bagnold. The best-informed among the native Arabs think that large quantities of camphor, myrrh, aloes, and frankincense, were used; these specimens will, however, prove that such were by no means necessary, as the tar, when applied alone, penetrates and discolours the bone. The tar is obtained from the branches of a small tree, or shrub, exposed to a considerable degree of heat, and found in most parts of Syria and Arabia Felix."—*Athenæum.*

Adhesion on Railways.—At a meeting of the Institution of Civil Engineers (reported in the *Athenæum*) it was stated that a great increase in the power of the engines in drawing loads after them arose from the use of wrought-iron rails, and wheels, hooped with wrought-iron, instead of cast. The Planet engine was instanced, weighing 7½ tons, and drawing 150 tons. The proportion of ordinary weight between the engine and the load might be called 1 to 7, though 1 to 11 was a fair representation of the power of traction as a maximum in favourable weather on a level. Case-hardened iron had been proposed for the rails, but had been abandoned in consequence of the chills, which answered perfectly at first, losing their effect by the repetition of the process, so that the case-hardening was not equably effected.

Cast and Wrought-Iron Wheels.—It was also stated, that where cast-iron wheels on railways would only last six or eight months, wrought-iron would serve at the same work three or four years.

The Wear of the Rails of the Manchester and Liverpool line was stated to be 1 120th of an inch in depth per annum. The flanges rarely come into contact with the rails; one of the oldest wheels being taken off a carriage, the marks of the turning-tool was found on the flange.

New Application of Caoutchouc.—India-rubber has been applied in Paris to the casing of steel busks for ladies' stays, and is said to answer well in resisting the metallic oxides upon the dresses.

French Academy Prize.—The great physical prize proposed by the French Academy of Sciences for 1837, is to be, for the determination, by anatomical and physical researches, what is the mechanism by what the sounds in the voice of man, and vertebrated and invertebrated animals, are produced.

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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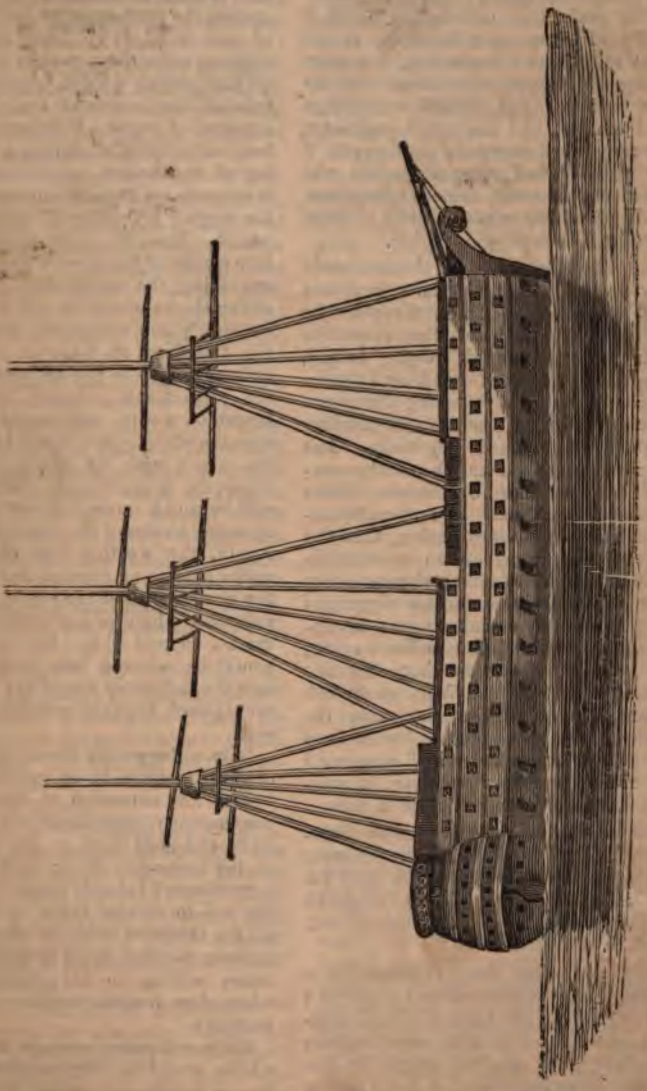

SHEER-MASTS.

SHEER-MASTS.

Sir,—In requesting the favour of the insertion in your Magazine of my plan for masting ships of the line with sheer-masts instead of those now in use, I am aware that those persons who have been in the habit of viewing the present system of masting and rigging ships, as approaching to perfection, will hardly think it worthy of attention; however, as all things must have a beginning, I venture to propose this great innovation, with the hope, that among the British and foreign naval officers, and dock-yard engineers, who may have access to your pages, it may possibly find some supporters who may deem it worth some experiments, which will either condemn it to oblivion or render its adoption advisable.

The experiments which I have made for testing my plan have been only upon a small scale, and will not, therefore, be considered conclusive. The respective masts were of equal weight, height, spread, and quality of wood, and the result was obtained by placing them in a horizontal position, and then suspending weights to them until they broke. The sheer-masts proved to be nearly one-third stronger than the others. Their superior strength may be reasonably accounted for by simply stating, that the whole of their fibres are in constant requisition for their support; whereas under present circumstances the lee rigging of a ship is not only of no assistance in supporting the mast and weather rigging, but actually distresses them by the amount of its weight. Whether the difference of strength be as double the weight of the lee rigging deducted from that of the entire mast and rigging, I will not pretend to determine; it may, however, possibly approximate to this.

Properly to test the strength of sheer-masts, I should recommend an experiment on a scale of not less in length than $\frac{1}{8}$th of a first-rate's main-mast, viz. about 15 feet; or $\frac{1}{4}$th the length, or about 30 feet, would be still better.

Now, supposing these experiments to be made with as favourable a result as I have obtained, the subject would assuredly be worthy of further consideration; and other good qualities might be discovered—*amongst others, a great saving in the naval estimates.*

I shall now proceed to point out my own views of the sheer-mast's good qualities as well as defects.

1st, and most important.—Its superior relative strength.

2dly.—Its tendency, upon the principle of diagonal braces, to strengthen a vessel's hull instead of weakening it, as does the present mast and rigging—For instance, the main-mast of a first-rate ship of war, with all its other masts, yards, rigging, sails, &c., weighs little short of 50 tons, which weight, together with the force of the tension of the rigging (the amount of which, I believe, has never been calculated) rests upon a small bearing of the keelson, upon which the mast is stepped, pushing it downwards, whilst the rigging is pulling the ship's sides upwards. Now, in a sheer-mast, supposing it to consist of five sheers, as shown in the engraving, the weight upon each bearing of the sheers would be only 10 tons. To exemplify how completely sheers perform the functions of diagonal braces, it is only necessary to get too weak planks of the proportional relative breadth and length of a ship, and rigged on the respective plans, when it will be found that the plank with the sheers will be prodigiously strengthened, whilst the other will be much warped, if not split, by the opposing strains of the masts and rigging. Again, the weather side of the latter, under a press of canvas, has to support the greater part of the strain, and the lee side none whatever; whereas in a sheer-masted rigged ship, the weather side would be relieved from half the strain, and the lee sheers would act as shores to the upward buoyant pressure of the lee side.

3dly.—Supposing the relative strength of sheer-masts to be so considerable as to bear a less extension of base, I should, consequently, place them inside the ship's hull, and abut them to the shelve-piece on the lower-gun deck; or if higher (for convenience) I should properly strengthen the hull to receive them, in which case all the channels might be dispensed with, making the ship much snugger, and certainly adding to her sailing qualities when close hauled, besides clearing her batteries.

4thly.—Greater stowage in the hold, which would be disencumbered of ponderous masts—excepting the main-stay sheer-mast, as proposed in the present plan.

5thly.—A great reduction of labour, time, and expense, in fitting ships out; as all the ships in ordinary would be absolutely rigged, as far as their lower masts were concerned—a point of great importance to a great Naval Power. This would include also a saving in the expense of the standing rigging—room in the storehouses of his Majesty's dockyards, and the employment of so many riggers.

6thly.—A sheer-masted ship could be more easily hove down, because weights and purchases might be more generally applied to sheer-masts without danger of carrying them away.

The above important qualities will well bear the placing in the opposite scale a few apparent defects, the greatest of which appears to be, the exposure to shot when in action, which is the reason I recommend a pyramidal sheer-mast to be composed of five sheers, for, independent of the effect of shot, I should only use three of them, as being the strongest mode of construction, the weights of the respective pyramidal masts being equal; with five sheers, three of them would support each other, in case two were shot away, so that probably a mast composed of five or six would stand as good a chance in action as the present single mast. This point, however, requires experience; and if spare sheer-masts would not be too cumbrous to take to sea, there would be much greater facility in repairing the masts after an action than at present.

It will be seen by the engraving, that the sheers are united at their upper end to a conical cap, forming the apex of the pyramidal mast, through which is placed the top-mast, with its heel properly secured by cross-pieces (as trusle-trees) united to the sheers.

The mode of combining the heads of the sheers to the cap in the strongest and most efficient manner, as also that of fixing the heels to the vessel's hull, might well form a subject for a patent; and, indeed, many inventions would arise out of the system, if its adoption should ever be contemplated.

As for the principle of sheer-masts, it has no originality whatever, having for ages past been adopted by the Chinese; many patents have also been taken out for them, the most modern by Mr. *Guppy, Mr. Higgins,* and Lieutenant Molyneux Thuldham; and if these gentlemen would have the goodness to state, in the pages of your Magazine, the result of their experience, it would throw additional light upon the subject, and possibly call the attention of the naval authorities to it, who, in consequence of the vast saving of naval expenditure which would accrue if the system could be adopted, might think it worth while to order an experiment to be tried at the mast-house of one of his Majesty's dockyards, which could be done at a trifling expense, in the manner in which I have already pointed out.

Supposing the present dimensions of our largest ships to be *doubled,* I cannot see how the difficulty of masting and rigging them could be got over, unless by the adoption of a pyramidical structure of sheer-masts of some kind or other, with the further addition of various kinds of braces to strengthen them. I have, therefore, shown in the engraving, sheer-masts to a first-rate ship of war, to illustrate my opinion, that the larger the ship, the greater the necessity of resorting to pyramidical sheer-masts. Whether smaller vessels should be fitted with them when the absolute necessity does not exist, may perhaps be questionable, but, generally speaking, the strongest principle is the best on any scale.

One argument in favour of the present system of rigging is, that the play of the masts and elasticity of the shrouds form the vessel's sailing qualities; and I know that many proofs could be given of that tendency by captains in the navy. Now, sheer-masts can have but a trifling degree of elasticity; but, then, for this as an objection to be borne out, it must be proved, on the other hand, that all vessels which have been hitherto rigged with them have been, consequently, bad sailers— If this cannot be established, and even the contrary be proved, the loss of play and elasticity will go for nothing.

The tendency sheers have of throwing out the ship's sides need hardly be mentioned, because it cannot be so very considerable as not to be easily restrained by proper modes of strengthening and fastening the hull; if, as I have heard, a ship's sides have opened by the lateral pressure of sheer-masts, it must have been entirely owing to want of discrimination, in not adapting the parts of the ship to the novel and different strain which she had to bear.

I shall only observe, in conclusion, that the above plan is such a prodigious innovation, that I fear there is but little chance of its merits being investigated; but should it be tried, I venture to prophesy that its rise in the estimation of the naval service, and the shipping interest in general, will be very rapid. The wonder will then be, why such vast sums of money have been expended, for ages past, upon standing rigging.

Those whose minds may be wavering respecting the superiority of sheer-masts, are cautioned to beware of Russians, merchants in the Russian trade, riggers, &c. who will be sworn enemies to the plan; but the timber trade, mast-makers, shipwrights, &c. will patronise it. How many plans for the general public good are withheld, or hunted down, because they militate against powerful individual interests! I strongly recommend such persons as would be benefitted by the adoption of sheer-masts, to exhibit the efficiency of the plan by fitting out a vessel with them. I would do so were I a shipowner.

Your obedient servant,

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THE SAFETY-LAMP.

Sir,—Allow me to occupy a small space in your columns by an explanatory remark in reference to Davy's so called "safety-lamp," to prevent misapprehensions similar to those under which one of the individuals examined before the Committee of the House of Commons for the Prevention of Accidents in Mines, appears to have laboured.

When I have stated that the Davy-lamp is *safe* when the wire-gauze is *red-hot*, I wish it to be invariably understood that it is in a *tranquil*, or unagitated atmosphere, which is meant. I have had it red-hot in an explosive atmosphere in the mine; Mr. John Buddle admits its being red-hot, yet safe; and Davy himself mentions the same fact. I am in the constant habit of exhibiting, in my chemical lectures, the wire-gauze red-hot, and so sustained by the lamp, when allowed to remain for some time in an explosive atmosphere at rest.

Your very humble servant,

J. MURRAY.

March 15, 1836.

THEORY OF LOCOMOTION.

Sir,—I will now, with your permission, make a few remarks on Mr. Herapath's theorem for determining the velocities on an ascending plane.

Suppose an engine and train have begun to ascend a plane rising 22 feet per mile, or 1 foot in 240, with a velocity of 40 miles per hour; then, by Mr. Herapath's theorem, the speed will be $\frac{40}{1+\frac{h}{22}} = \frac{40}{2} = 20$ miles an hour, and the time of going over one mile will be $t = 1 + \frac{h}{11} = 1 + \frac{22}{11} = 3$ minutes.

If Mr. Herapath has erred in excess in his theorem for finding the velocity for a descending plane, he has fallen into an opposite error in determining the speed on an ascending plane. For let us suppose that on beginning the ascent with a velocity of 40 miles per hour the steam is turned off, then $\frac{1}{240} \times 2 = \frac{1}{120} = \sin. i$, then $V = 58\frac{2}{3}$ feet per second, then $v = \sqrt{V^2 - 2\,g\,S \sin. i} = \sqrt{(58\frac{2}{3})^2 - 64\frac{1}{3} \times 44} \cdot \frac{15}{22} = 16{\cdot}855$. Consequently, the average velocity for one mile will be at the rate of $\frac{1}{2}(40 + 16{\cdot}855) = 28{\cdot}427$ miles per hour, and the time in which one mile will be run over will be $60 \div 28{\cdot}427 = 2$ minutes $6\frac{1}{5}$ seconds. Or the time may be found, independently of the final velocity, from the theorem $t = \frac{V - \sqrt{V^2 - 2\,g\,S \sin. i}}{g \sin. i}$ $= \frac{120}{32\frac{1}{4}}\left(58\frac{2}{3} - \sqrt{64\frac{1}{6} \times 44}\right) = 126{\cdot}6$ seconds $= 2$ minutes $6\frac{1}{5}$ seconds, the same as before.

Let us now see what the results will be on the supposition that steam is applied as efficiently on the ascent as on the horizontal plane, or just to overcome friction. In that case we have $v = \sqrt{(58\frac{2}{3})^2 - 64\frac{1}{3} \times 22}\ \frac{15}{22} = 30{\cdot}693$; hence the average velocity per one mile will be $\frac{1}{2}(40 + 30{\cdot}693) = 35{\cdot}346$ miles per hour, and the time will be $.60 \div 35{\cdot}346 =$ 1 minute $41\frac{4}{5}$ seconds.

For the present I shall only add, that in the above calculations, as well as in all the other calculations I have given on this subject, where friction has been taken into account, I have supposed that in very small arches A and B, $\sin.(A \pm B) = \sin. A \pm \sin. B$.

I am, Sir, yours, &c.

IVER M'IVER.

EPITOME OF THE PROBLEMS OF DR. ROGET'S SLIDING-RULE OF INVOLUTION.

Sir,—I find among my papers the following epitome of the problems capable of being solved by Dr. Roget's Sliding-Rule of Involution, of which instrument an account is given in the *Mechanics' Magazine*, vol. xiv. p. 172:—

Powers and Roots.

$$\begin{array}{lcc} & a^{\frac{1}{m}} & a \\ \hline \text{Sli.} & 1 & m \end{array} \quad (1$$

$$\begin{array}{lcc} & a & a^{n} \\ \hline \text{Sli.} & 1 & n \end{array} \quad (2$$

$$\begin{array}{cc} a & a^{\frac{n}{m}} \\ \hline m & n \end{array} \quad (3$$

Since the numbers on the stock are all greater than 1—when $a \angle 1$.

$$\begin{array}{cc} \frac{1}{a} & a^{-\frac{n}{m}} \\ \hline m & n \end{array} \quad (4$$

Compound Interest.

$$\begin{array}{cc} 1+r & (1+r)^{n} = \text{amount} \\ \hline 1 & n \text{ years.} \end{array} \quad (5$$

Interpolation of n geometrical *means* between a and b. Slide to be moved by trials, until

$$\begin{array}{cc} a & b \\ \hline p & q \end{array} \quad (6$$

q and p being such, that $q-p = n+1$, then

$$\begin{array}{ccccc} a & \text{1st mean} & \text{2d mean} & \text{3d mean, \&c. to } n\text{th mean} \\ \hline p & p+1 & p+2 & p+3, \text{ \&c. to } p+n \end{array} \quad (6$$

Exponential Equation.

$$\begin{array}{lcc} & x^{x} & x \\ \hline \text{Sli. inv.} & 1 & x \end{array} \quad (7$$

System of Logarithms.

$$\begin{array}{lcc} & \phi & n \\ \hline \text{Sli.} & 1 & \text{log. } n \text{ in the system whose basis is } \phi. \end{array} \quad (8$$

J. W. WOOLLGAR.

Lewes, March 5, 1836.

Fig. 1.

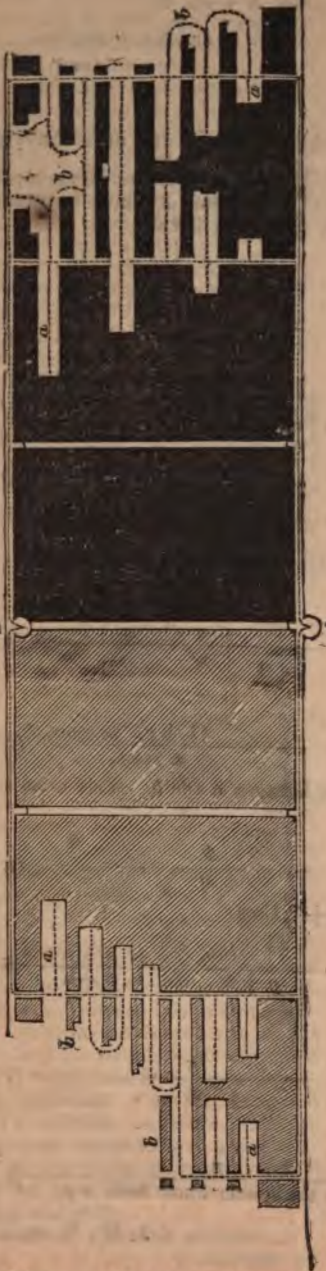
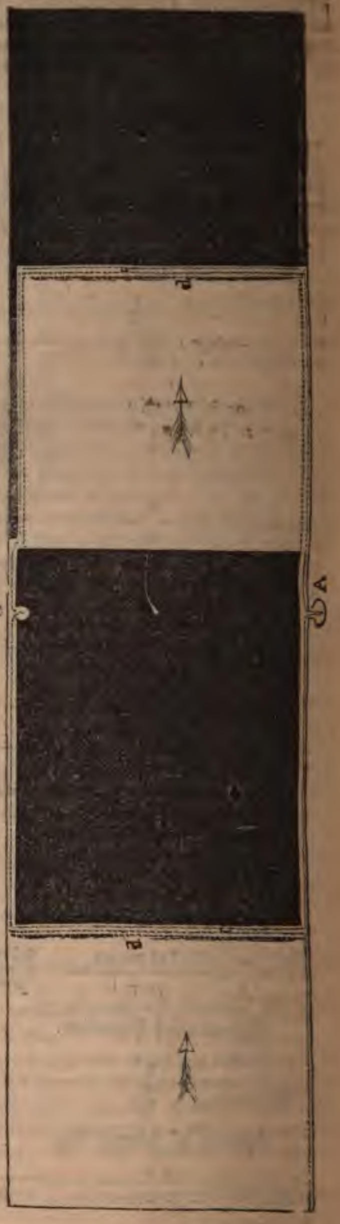


Fig. 2.



Sir,—I have read with very great interest, in the January Part of your valuable Magazine, the evidence before the Parliamentary Committee appointed to inquire into the Accidents in Coal Mines; I think the highest praise is due to you for making that evidence more generally known, as I feel convinced the perusal of it will lead many scientific individuals to give the serious consideration which its importance demands.

On a careful examination of the evidence, it would appear to be the decided opinion of those who are practically acquainted with mining operations, that the present system of ventilation in the North of England mines is very imperfect, and I would beg to call the attention of some of your mining correspondents to what appears to me to be the radical defect in that system, and also to propose a plan which I humbly suggest would ensure a more perfect circulation of air.

The present method of working the coal-seams in the North is, I believe, by getting it in long, narrow openings, divided from each other by slender ribs or pillars, which are subsequently got out at considerable risk; for it would appear from the evidence that here the greatest danger from inflammable gas is always to be apprehended, in consequence of the imperfect manner in which pure air can be conducted among the workings.

To make this mode of working more apparent to your readers, I would beg to refer them to the sketch, (fig. 1) in which I have attempted to show the plan pursued in working and ventilating mines on the pillar system, and by which they will see how numerous the distinct openings required, each of which, I would observe, must be supplied with a current of air whilst in progress.

A, shaft at which the coal is drawn up out of the mine; B, air-shaft; *a a a*, stalls or openings by which the coal is worked; *b b b b*, narrow ribs of coal left between each opening to support the roof, which are subsequently removed. The dotted lines show the manner in which the air circulates through the workings. The dark part shows the unwrought coal.

Let us suppose (which is no uncommon occurrence) that in one pit twenty of these stalls or openings are occupied at the same time by separate sets of miners, and that each set, as a natural consequence, requires a certain portion of pure air to support respiration, and clear away inflammable or noxious exhalations. By the aid of a furnace, or some other method, a current of air is produced, which, while it is confined to the more contracted part of the workings, may be more than sufficient for the purposes of ventilation; but when this current is divided into twenty or more portions, its original force becomes greatly weakened, and its efficiency for the purpose required, ofttimes utterly destroyed; nay worse, it is converted into an instrument of positive danger, from its conveying into the works that proportion of air only which gives to the inflammable matter its most dangerous and active shape for ignition.

To obviate this very objectionable mode of ventilation, and to do away with so many distinct openings which render the coal smaller by cutting it up, as it were, into shreds and patches, I would propose, for the consideration of the Northern coal-viewers, the propriety of their attempting to work their coal-seams after the manner of Derbyshire and Nottinghamshire, by what is technically called *long work*, of which plan, fig. 2 is a sketch.

A, shaft at which the coal is drawn up; B, air-shaft; *c c*, the openings in which the coal is got, commonly called the *works*, or *banks*, these vary in length from 80 to 150 yards; *d d*, two rows of props, which support the roof, the back row of which is always removed to the front as a breadth of coal is worked off. The shaded part shows the unwrought coal, and the unshaded where the coal has been wrought out; the roof over this part, when the back row of props is taken away, falls down and fills up the opening made by the removal of the coal. The fine dotted line shows the course of the air to ventilate the works.

By pursuing the above plan, one direct and undivided air-course would always be ensured, which, with the most ordinary attention, could rarely fail to render the works perfectly secure; the current of air obtained by this method being generally so strong, as to oblige the workmen to make temporary barriers of litter to check its force. The coals, too, by being taken down in one extended, unbroken length, would be produced much finer, and, I presume, at considerable less expense; and their increased size and improved appearance, would, doubtless, command that preference for them in the market which it is always desirable to obtain.

In further support of my views on this

subject, I would beg to quote a remark made by your talented correspondent, Mr. Deakin, in the 17th volume of the *Mechanics' Magazine*, p. 122, where, alluding to *long work*, he says:—"The regular current of air along the open face of the coal will sweep away all impurities, and keep a mine as sweet as any house above ground."

Should this method of working the coal be adopted, there would be no necessity for using the miscalled safety-lamp, except in the first openings of a pit, where but few individuals are employed, as those parts of the mine where the main body of the workmen would be engaged (being in the direct line of the air-course), would always be freed from that subtle enemy, whose destructive agency has consigned so many valuable and industrious members of the community to a horrible and untimely end.

I would beg further to observe, that the plan generally adopted in the North, of placing the furnace at the bottom of the shaft rather than the top, seems to be attended with great objections, as the process of combustion cannot be carried on without a considerable supply of the most valuable components of pure atmospheric air; and the more freely this supply can be obtained, the more active will be the process of combustion, and, as a necessary consequence, that circulation which it is intended to create—whether this supply is more likely to be obtained in greater abundance at the bottom of a deep shaft rather than the top, I leave your reflecting readers to judge; I will only say, that I have known many instances in the case of choke-damp where a fire has absolutely been extinguished at the bottom of a pit, and could only be got to burn by raising it nearer the surface.

I am aware it may be urged against this, that the greater specific gravity of what is commonly called choke-damp will not admit of a comparison being drawn betwixt the means used for expelling this from a mine, and those required for extracting the lighter and more subtle hydrogen; but this general argument, I would remark, applies to either, that the more speedily the foul air which is drawn to the furnace can afterwards makes its egress to the surface the better, and with the more certainty will be obtained that desirable result, free and wholesome circulation.

I am, Sir,
Your very humble servant,
THE BLACK DIAMOND.
Kilburne, March 3, 1836.

Sir,—In your valuable *Mechanics' Magazine* you have given the substance of an inquiry before a Committee of the House of Commons as to the cause of accidents by explosions of gas in the Northern collieries, in which human life is so frequently sacrificed; and I was very much gratified by many of the questions proposed, as well as by answers given.

It seems to me that the whole of the Committee's attention was taken up by the examination and making experiments upon the different safety-lamps in use in those collieries; and the inquiry ended without any thing being done to put an end to the evil complained of. The experiments made upon the "safety" lamps proved that few of them have any *safety*, and that not one of them can be depended upon under all circumstances.

Would it not have been advisable for the Honourable Committee to have put some questions to the different scientific gentlemen and coal-viewers they examined to the following effect:—

Do you know any better method than the present of working the coal in the Northern collieries, and by which explosions may be avoided?

Do you know any better methods of ventilating mines than those at present in use in the Northern collieries?

Do you not think it necessary that some plan should be adopted, in working the coal in those Northern collieries, which should set aside the use (except in particular cases) of the safety-lamp?

Now, sir, I beg leave to suggest two plans which would certainly go far to prevent the dreadful accidents, which are so frequent under the existing system. The first is, sink the pits for working the coal in those collieries nearer together, so that the atmospheric air shall not have so far to traverse as it now has in large collieries, through old workings, &c. Let the Government make a law, compelling coal-owners to sink their shafts within a certain distance from each other; the number of yards to be mentioned in the proposed law. The second is, that the coal shall be worked by long work, instead of stall and pillar work. In the *Mechanics' Magazine*, vol. xvi. p. 372, the method of working coal by this plan is explained. Long-work is universally adopted in the Shropshire coal field, and is quite as practicable in the north of England.

Yours, &c.
THOMAS DEAKIN.

Note on the two preceding Communications, by the Editor.

The evidence taken before the Select Committee of the House of Commons on Accidents in Mines, was of so voluminous a description, that we were necessarily obliged to limit our extracts to so much of it as went to illustrate the leading views taken of the subject in the Report of the Committee; and hence the omission of certain portions of the evidence, which, if they had been published, would probably have induced the intelligent authors of the two preceding communications to modify considerably the high opinion they entertain of the long-work system of mining. The Committee seem to have looked on the question of substituting that system as quite disposed of by the evidence given before them; and they do not, therefore, in their Report, hold out the least hope of any remedy from that quarter for the lamentable accidents, the prevention of which, formed the object of their inquiry. The advantages claimed for the long system, when combined with the plan of ventilation introduced by our ingenious and worthy friend, Mr. Ryan, into the Staffordshire mines, where his system is generally followed, are, 1st, greater economy, and, 2d, greater safety—Mr. Ryan's theory being, that " where there is no dislocation of strata, there can be no confined carburetted hydrogen;" and that by opening clearages or air-courses along the *backs* of the coal, wherever such dislocations occur, the gas may, by virtue of its superior levity, be carried off to the surface. We subjoin as much of the evidence on these points as may serve for a justification of the conclusion come to by the Committee:—

1st. Economy of the Long-work System.

Mr. Buddle, principal Coal-Viewer in the north of England.

" *The next system I tried* embraced the principle of long work, generally called the Lancashire system; it succeeded very well so far as regarded the obtaining of the greatest quantity of the mine; but it brought another evil upon us which more than counterbalanced the advantages resulting from that mode of working; in fact, I may say that it induced a double mischief: the first was the increased quantity of small coal produced, as there was an incessant pressure and grinding upon the walls which crushed the coal exceedingly, and caused a great produce of small coal which was of no value; but the chief mischief attending it was the breaking of the strata up to the yard coal-seam,* which I have already described, and thereby bringing upon us a double supply of gas.

" By the long-work, I should think we might have obtained nearly 90 per cent. of produce, but much of that was left below on account of being so much crushed; we could have brought it up if it had been a saleable article, but it was so excessively crushed that it would not pay for bringing out."

Mr. George Mitcheson, Mine Agent, Staffordshire.

" In reflecting upon the modes of working with which you are familiar in the north of England, has the practice of the district in which you are now engaged suggested to you any idea by which the safety of the north country mines might be increased?—No, I do not know that it has; I do not see that they ever could get the quantities in the way that we work, which they do in their own way."

2nd. Safety of the Long-work System.

Mr. Buddle.

" Can you give the Committee any information as regards the Dudley district?—I can. I consider their mode of ventilating their thick seam very good in principle. I must beg to be understood as speaking of the thick seam, the forty-feet seam; the fact is, that it is a great number of seams collected together; it appears as though a number of seams were collected together, and only divided by thin layers of what we call band. With regard to the ventilation of those mines, I consider their system by discharging the gas round the top drift very complete, as the great height of the seam is favourable to that plan. The work is carried on in chambers, called sides of work in these particular districts, or large chambers: the system of ventilation is effected by putting a top drift round something like the cornice of this room, and there are small apertures made between these drifts and the top of the chamber, by which the gas is carried off into the top drifts. The opening where the horses enter at the floor of the chamber to take away the coals, serves as an inlet for the atmospheric air, which naturally ascends and passes into the top drift by the little holes already described, and carries off the gas with it.

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* An upper seam of the Bensham colliery much charged with gas.

"So that, in fact, the great height of those seams renders the operation of ventilation easy?—It is easy under those circumstances.

"Do you know whether they are liable to great contingencies and accidents by the falling of the roof?—They are, I believe; not so much from the falling of the roof, as from the falling of the coal. I believe that accidents are pretty frequent. The first process in this working is to dig out five or six feet at the bottom of the seam, but leaving a single strong pillar in the middle of the great mass of coal, which pillar they call the 'man-of-war:' it is a square pillar, left in the middle of the side of work, about four or five yards square. It supports the immense mass above of about thirty feet thick, like a pillar or pedestal of coal. It is called the 'man-of-war.' The workmen then dig upwards all round the mass, making foot-holes on each side as they proceed upwards, forming a narrow niche, barely sufficient to allow them shoulder-room to get to work in. It frequently happens, (I have not been in to experience it myself,) I am informed, that one of the lamina or leaves of coal will give way and crush the bodies of those men in the niches, and that lives are lost in that manner. After they have proceeded to a certain height in this manner, the last operation is to remove the 'man-of-war,' which is done by transverse passages driven through it horizontally; it then stands upon four slender legs, or feet, which sometimes yield, and are crushed from the weight above; but if that should not happen, the fall of the mass is effected by a kind of battering-ram, which the workmen strike against the legs of this man-of-war, till they nibble and weaken them, so that they give way to the pressure, and down comes the mass altogether. I have seen one of those masses immediately after its fall from that operation. This is the Staffordshire mode of working this thick seam.

"Was your impression that the safety of the workmen was sufficiently consulted in that mode of working?—I think it was, as far as the nature of the work could admit; every care seemed to be taken, by putting in struts and stretches, &c., and all that kind of thing, which colliers understand; but, at the same time, casualties will happen under that hazardous kind of employ.

"*Did the mode of working* the thick mine *in Staffordshire engage your* particular attention?—It did, inasmuch as I felt a great regret that so small a proportion of so magnificent a seam was obtained.

"Did it occur to you that any better mode of working that mine might be adopted?—It did; but I am afraid that in any improvement in the mode of working, if one inconvenience is remedied, others might be incurred. The great difficulty of adopting any other mode of working arises from the immense height of the roof; you cannot have the advantage of propping, therefore the roof ought to be the last thing bared; and they are subject also to the ground fire, the slack, when left under ground, if air is admitted into it, spontaneous combustion takes place, and that adds very greatly to the difficulty of improving the mode of working that splendid seam."

Mr. Nicholas Wood.

"This porosity of the coal, I think, corroborates what we find in experience in working the mines: in the course of working, we find the gas issue *from innumerable pores over the whole surface of the excavation;* that is one mode in which the gas is evolved in the mine, and the force with which it is evolved depends very much upon the depth of the mine, and other circumstances respecting the dikes that cross the coal strata almost in every direction."

Mr. Buddle (speaking of the Bensham one-yard seam).

"I found the seam prodigiously fiery, so much so that the coal itself afforded gas enough to light the pit.

"Was that independent of any particular fissure or brack?—Yes; I simply drilled a hole into the solid coal and stuck a tin pipe into the aperture, surrounded it with clay and lighted it, and I had immediately a gas-light; the quantity of gas evolved from the coal was such, that in every one of those places I had nothing to do but to set a candle, and then could set a thousand fissures on fire: the whole face of the working was a gas-pipe from every pore of the coal; and when the shots were fired for blasting down the coal, they generally set fire to the gas as it was evolved from the coal."

Mr. G. Mitcheson.

"You mean to say, that you think that the mode adopted in the north is equally safe with your own, and that they are enabled to get greater quantities than they would obtain by the adoption of your system?—Yes, they do get greater quantities, and I do not know that our system would be more safe than theirs.

"Does it strike you that the principle of long-work might be applied to that colliery?

—It would appear that if the roof should break down close behind the work, there would not be that space for sulphur or foul air, and so no room for sulphur. The current of air passing along the work would, I think, keep it clear, and so might prove an advantage. But in many cases in the north they have a post or stone roof, in which case it would stand perhaps for forty or fifty yards upon an area. I do not think that long-work could be at all practised there, for it would never break down behind them, and there *would be ten times more space for foul air than there is now.*"

PROVINCIAL MUSEUMS AND DISTRICT INSTITUTIONS.

Sir,—As an ardent friend of these useful establishments, which are continually increasing (many of them have already assumed a permanent character), I take leave to direct the attention of your numerous and intelligent readers to some very important evidence given before the British Museum Inquiry Committee in the last Session of Parliament. The Principal Librarian being asked whether there would be any objection to bestowing duplicate books or duplicate objects of curiosity upon district institutions or libraries, says, "that there would be no objection *in principle;* it would make the *duplicate objects more useful to the community*" (No. 565, 566).—"It would be consistent with the Act of 47 Geo. III." (No. 567.) The Reverend Secretary being applied to for his opinion on the subject, remarks, "I think there would be *no objection whatever* so to dispose of objects not given to the Trustees; *it would be a very useful thing to do,* with respect to certain classes of duplicates." A question being put to the Principal Librarian respecting the presentation of duplicate *coins,* he makes a most extraordinary reply, namely, "that a small cabinet of coins could be of no advantage to a local institution" (No. 580). The Secretary, of course, agrees with his Principal, and also adds, "that a *large portion* of the books which were sold a few years ago,* would be of little use to any local or district library" (No. 582). The same gentleman being asked whether he did not think that duplicates of coins in the Museum might be bestowed with advantage upon such institutions as are found in Liverpool and Manchester, very sagely replies, "I do not say they might not be bestowed with advantage; but I think *the most convenient method is for the Museum to sell them,* and out of the proceeds to supply its own deficiencies, *and for such institutions to buy* what they want; that is the readiest and most *economical* mode of effecting the objects of *both* parties" (No. 583). He is afterwards applied to for his opinion, whether it would not be better to present casts of the coins to the local institutions; and he very quietly and cautiously observes, "that might be done" (No. 584). But will *any thing be done* in this matter, unless the local institutions, and we include the Mechanics' Institutes, resolutely bestir themselves, and, one and all, immediately *petition Parliament* to be allowed to share in the distribution of any duplicate books, coins, prints, objects of natural history and of art, or of any other curiosities that have already accumulated, or may, from time to time, accrue in the British Museum, should such a disposition of them be recommended to Parliament by the Committee. Let *this be done* forthwith; let these petitions be transmitted to the different Members of Parliament, representing the places where any institutions may be established, with an urgent request that they will support the prayers of the petitions intrusted to them, and use all their influence with the Committee of Inquiry *now sitting* to induce them strongly to recommend this measure in their Report to the House. Some powerful exertions must be made, or the district institutions will lose the chance of obtaining the most important advantages. These establishments are now numerous and respectable enough to command the attention of the Legislature; and yet the Reverend Secretary aforesaid says, that "*very few* scientific institutions exist among us which can be said to have a permanent and public character; if there were provincial museums *recognised as useful by the Legislature or Government,* the Trustees would, no doubt, contribute to such museums, whenever they could do so, without interfering with the completeness of their own collections" (No. 609). I will not insult the common sense of your readers by attempting to expose the absurdity of this remark, or bestow a single comment upon the ignorance displayed in it. There *are* numerous provincial museums and institutions in the United Kingdom of a "permanent and public character;" and this is the precise moment in which they should be "recognised as useful by the Legislature." The first step towards obtaining this desirable object is, to present petitions; and I am confident I can take no better means of recommending this measure to general adoption than the channel of the *Mechanics' Magazine*, which in the course of "one little week" usually finds its way to every town in the United Kingdom.

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* We suppose the Secretary alludes to the great sales in 1831-2, when 12,338 volumes were disposed of by auction, besides 2,072 selected by the Royal Society in exchange for manuscripts. Would not *many of these have been useful to district institutions?*

It were an act of injustice to conclude this appeal to the directors of district institutions without informing them, that they are indebted for whatever benefit they may derive from the Museum Inquiry, to Benjamin Hawes, Esq., the Hon. Member for Lambeth, whose unwearied perseverance in every thing he undertakes, as well as his extraordinary tact and discrimination in eliciting information from witnesses on the multifarious subjects of art, literature, and science, presented to his notice in the course of this important inquiry, are too well known to need any eulogium, and are far beyond the writer's feeble praise.

I am, Sir, yours, &c.

S. S.

P. S.—Such of the directors of provincial and district museums and institutions as may not be able immediately to refer to the British Museum Evidence of 1835, are recommended to consult some well-written and concise strictures on that Evidence by Mr. Edward Edwards, comprised in a "Letter to Benjamin Hawes, Esq., M. P." Vide pp. 25 and 51. Not the least valuable part of this *brochure* is an Appendix, containing "Heads of Inquiry relative to the Improvement of the British Museum," to which the attention of all persons "anxious to extend the utility of that institution" is earnestly requested by the author, "as well as any further suggestions calculated to promote the object of the present inquiry—the utmost possible realisation of the great *national purposes for* which the Museum *was originally founded*."

COURT OF COMMON PLEAS, GUILDHALL, 25TH FEB., 1836.

Before Lord Chief Justice Tindal, and a Special Jury.

MACINTOSH v. EVERINGTON.

(Continued from p. 495.)

Continuation of Mr. Serjeant Wilde's Address to the Jury.

Mr. Macintosh says in the specification, "The best mode I have found out of carrying this invention into effect, is by the application of coal-oil produced in making coal-gas." Now Mr. M. was engaged in the preparation of a solution made from coal-oil before he obtained his patent, which process he then, as well as after, kept a profound secret, and conducted, not on the premises where he manufactured the cloth, but on adjoining premises with a separate entrance. Mr. M, continues to prepare that solution up to, I think, 1825, till he moves to Manchester; he continues to prepare it there. Who knows how he prepared it! Nobody. Does he use it! No, nor ever did. What is the use of calling chemists to produce half a sheet of paper, and to say we have done this from the specification! The deception of all these experiments is this—that a trifling experiment upon a limited scale, where expense is no object—where it is the subject of constant attention for a time and for a particular purpose, is no test of the same thing on a large scale, where expense is of the utmost importance, and where cheapness is necessary for success. Is there any judgment so weak as to be imposed upon, and to be caught by this birdlime of my learned friend! The evidence is, that he gets his material from the coal gas-works, mixed; I mean in one vessel with tar, &c. Are they used in the state in which they come? Never. Now I beg most particularly to rivet your attention to the fact, that Mr. Macintosh manufactured his own solution, and continues to do so to the present hour. Instead of calling the workmen,—where the contest is, if a particular article is applicable to a particular purpose—not a single workman is called to prove that a yard of cloth was ever made in the manner alleged; but, for some purpose, they call chemists to say it could be made. What need of experiments where a thing has been carried into effect, actually as a matter of trade; you may want experiments, but the experiments of a hundred cloaks made from a certain number of gallons of that oil, that would be an experiment of Mr. Macintosh's factory very well worth submitting to your attention indeed. The plaintiffs cannot prove that they use the oil as it comes from the gas-works; if they did, where would be the use of the secrecy which was maintained! What is the mode in which the solution is rendered applicable to the purpose? It is a secret, and when some is wanted for experiment none can be got but what is bought ready prepared at the dry-salters, and what is furnished by Mr. Blunt. If it is so easy, why do not the chemists make it for themselves? Not one of them has attempted it. Mr. Neilson, a workman employed at the gas-works, has produced a specimen of cloth of his own making from India-rubber solved with the crude coal-oil: that has been made some time; it has been kept near a stove—forgive my asking you just to apply your nose to it!—Suppose yourself seated in your carriage, or a stage-coach, with a nice warm great coat well saturated with such stuff, see what the unanimous voice of the rest of the passengers would be, and that very soon. Now that is made from the article in its natural state. Now look at that article as an useable article, as an article of commerce, and compare it with that cloak—[*handing to the Jury Fanshaw's cloak*]—and now tell me what would be the degree of competition which would prevail in the market between a coat made of that description and an article made in the manner in which you have seen? All their specimens, both of art and fabric, leave them in the same predicament. Don't let my friend talk of their being imperfect specimens. I say they are the best he could produce for his client; he had every interest, every means, to produce the best; he has a factory, good workmen, stoves, and if he dare pollute his place by the use of a single pint of this nasty stuff, he could produce it in its best form. The fact that Mr. Macintosh cannot prove, that he ever used a single ounce of that nasty liquid for the purpose of his manufactory; that the specimens he produces are imperfect, offensive, and such as to be wholly unsaleable—proves that he, when he said that the best mode which he had discovered was the use of that coal-oil, made a grievous mistake. He says, we told you it was to be pure, and therefore you must have known, that by being pure it was to be distilled; that is an odd word to apply to purifying. Gentlemen, you do not call, I apprehend, making a liquid from barley making it pure, when you make it into gin? Can any man at this moment make these cloaks by this specification, so as to compete either with Fanshaw or Macintosh? Supposing the patent out of the way, have they the means of doing it? Macintosh don't use even what he can buy; he has discovered some mode of preparing the solution by distillation (for there is a still on the premises, therefore I suppose it is to be distilled); he prepares it in some mode or other so peculiar, that out of Court, and in the course of his business, he keeps it a profound secret. Mr. Macintosh, to use my friend's expression, was a step in advance in one thing, that is, in having *discovered a mode of* making a solution; but the nature of that step, first, he does not choose to disclose, and, next, he don't claim a patent for it; he disclaims the solution. When he talks of the oil being pure, if he did mean it was necessary to distil that, why did he not say so in terms? I will tell you how he should have expressed it: he might have said, " take these articles, dissolve them in highly rectified coal tar-oil," or he might have omitted the word " tar," and said, " dissolve them in highly rectified coal-oil," that would have informed us at once. Mr. Hancock, three years after, in his patent says, " Take two pounds of caoutchouc dissolved in one gallon of equal parts of oil of turpentine and highly rectified coal tar-oil." That is the way he expresses himself. Why is the same not done here? But, gentlemen, here is another test. I ask, pray what were the proportions that your crude oil, as it is called, bore to the highly distilled? Why they say the crude oil dissolved ten ounces to a gallon. What does the specification say, " When the caoutchouc is of the best quality, and oil pure from ten to twelve ounces, and the latter will be found to answer"—giving the very quantity attached to the crude oil, not the quantity according to them; but which, according to them, is eight ounces instead of ten; so that every part of it shews that Mr. Macintosh perfectly well knew if he could only lead the noodles to attempt to water-proof their cloth with coal-oil produced in making gas, he was quite safe, not only during the patent, but ever after; it would make it so nasty an article as to be perfectly useless. I therefore say, that with respect to his specification, it is manifest and clear it was intended to conceal what was the only article which could be usefully applied, that article Mr. Macintosh has up to the present moment concealed. The principle of this patent was old and well-known; I will trace it; I will show what has been its progress up to the point when my friend says Mr. Macintosh succeeded in getting a step in advance. I apprehend that that which is disclosed in well-known books, and known, no doubt, to Mr. Macintosh, a man of science, a member of the Chemical Club, and, I dare say, of many other learned societies, and known to those gentlemen who came here to say, " Why we move in that circle in which we hear of every thing wonderful; of course we know of all the patents,—we concentrate a mass of knowledge among us, and a spirit of inquiry, that would astonish you if you were a member of the Chemical Club;—we almost know things intuitively—nothing is new to us—we have heard of all that has occurred—and therefore you may safely take it for granted, if we did not know it, it did not exist!" Now, Baron Humboldt's work was published in 1819, called the "Personal Narratives" of the travels of this person. Now here we are dealing with India-rubber in a liquid state applied to make fabrics water-proof. This gentleman, in alluding to that subject, says, "In comparing the milky juices of the papar, the cow tree, and the hevea, there appears a striking analogy between the juices which abound in caseous matter and those in which the caoutchouc prevails. All the white and newly-prepared caoutchouc, as well as the impermeable cloaks manufactured in Spanish America, by placing a layer of milk of hevea between two pieces of cloth." This is the caoutchouc as it comes from the tree in the state to which it is most desirable to reduce it: if you can reduce caoutchouc to a state of solution similar to that in which it comes from the tree; the effect of its being placed between two cloths, is to render it water-proof. Now that is the statement. "Placing a layer of milk of hevea between two pieces of cloth, exhales an animal and nauseating smell. This seems to indicate that the caoutchouc in coagulating carries with it the caseum, which is perhaps only an altered albumen." Further, I shall call a witness before you who will prove to you that in Demerara there was to be found in the store-houses cloaks made water-proof by India-rubber between two folds. One of the conditions on which the patent is granted runs thus:—"Provided that these Letters Patent were and should be upon condition, that if at any time during the term thereby granted"—certain things should appear to the King in Council, and so on—"or that the invention was not a new invention as to the public use and exercise thereof in Great Britain and Ireland, and also in all his said Majesty's colonies and plantations abroad," and so on, the patent is to be void. Now I will call a respectable gentleman before you to prove that this was an article in the store-houses in public common sale in Demerara; that it was in use there as water-proof cloaks before the obtaining of this patent. I ask, if that is well known, what is the invention of Mr. Macintosh? I admit, that if the India-rubber, being in the state in which it exudes from the tree, could be used for this purpose; but coming here it changes to a state no longer fit and applicable, and that it required art and invention to alter the subsequent state and condition, and to restore it to its original state of solution—I admit, that for the means of altering it from its present condition, and bringing it back to its state of solution capable of being used for those means, a party who discovers it would be entitled to a patent, but that is not what Mr. *Macintosh claims*, that is what he disclaims; *the solution he disclaims*; what he claims is *putting the India-rubber*, while in a state of solution, between two cloths. The means by which it is restored from its altered state when dry, and exposed to the atmosphere in a state of solution, being out of the case, and no part of his patent. The hevea tree is perfectly well known to these parties by a patent, obtained by Mr. Hancock in the year 1825, a very short time after this patent. He says, "The liquid I have mentioned is brought into this country, and is said to be the juice obtained from certain trees which grow in South America." Now this is the patent obtained by Mr. Hancock. The patent in question is obtained by Mr. Macintosh, but I show a public document, inrolled in the Patent-office, of one of these parties, showing that the nature and quality of this thing was well known. Couple these two together—here is the juice of the hevea tree as common India-rubber—here is the juice of the hevea tree placed in a liquid state between two fabrics perfectly well known. The next object is to evaporate and get rid of every substance but a thin layer of India-rubber, with as little of foreign matter as possible. I shall prove to you that some socks were publicly sold, consisting of two pieces of cloth fastened together, and India-rubber between. Here is the principle of two fabrics united together by a flexible cement; and it happens that flexible cement is India-rubber, and nothing remains to distinguish it from the most perfect identity; but my friend says, "the one is put in in a state of solution, and the other entire." But for use they are in identically the same state after evaporation. That which is introduced in addition to the India-rubber, for solving it, is but the vehicle—is but the convenient mode of manufacturing it; therefore I apprehend this will be most material, to show that the whole principle of this patent was well known. I shall then further show to you that these gentlemen themselves (I refer to the second patent of Mr. Hancock's), perfectly well knew that when they meant rectified oil, it was their duty to state it, and accordingly Mr. Hancock in 1826 did state it. I shall then show to you the specification of the patent of a Mr. Johnson taken out in the year 1797. He rendered his garments water-proof with India-rubber, the surface of which he covered with something in the nature of a flock, or cloth torn in pieces, as a lining. The difference between Mr. Macintosh's and Johnson's is, that the latter proposes to line or cover the surface with flock or some such article, and the former with a different material—a piece of cloth. Here is another similar article joined together by a solution of India-rubber; it is part of Mr. Green's balloon which was lost at sea, I believe on the day of the Coronation of George IV.; when I say lost, it was broken; the balloon was obtained, and that piece you now have is part of the balloon converted into a pipe, which was used for the purpose of filling the balloon with gas. It was applied to the vessels in which the gas was made, and conveyed through that pipe to the balloon. There, you have got the principle of uniting two fabrics by a solution of India-rubber, and that is the patent; and in a balloon an invention is made public enough. This piece of the balloon being to be exposed to the air, is not made precisely as soft as the cloak, but the principle is the same; and Mr. Green will tell you, too, that he afterwards cut up the balloon and make cloaks and capes of it, and gave them to his friends, who wore them as water-proof garments. I must say I think it would have been well if Mr. Macintosh, in his specification, had told the public that to make the cloth air-tight it would require four or five coats, but to make it water-tight, only three or four; because the test by which you are to regulate your judgment is this—is there such an account given as will enable an individual, at all acquainted with the subject, to use the invention with all its advantages when the patent has expired?—and this, referring to 1823, not allowing yourselves to be misled by the state of knowledge of this article which has grown up since. Mr. Macintosh's patent is not for cloaks only,—you must not make an air-balloon, nor socks, nor any article after his plan. My learned friend will argue that this is a flexible cement, to be used in the manner described, and will therefore refer to that manner. Mr. Macintosh will acknowledge he used this known solution to produce this known effect, but will say he did it in a peculiar manner, and that therefore he is entitled to his patent. That very part of the manufacture he has departed from, and to this hour does not use it. Does he use the brush? No. He applies the solution that he makes in secret not by any manner stated in the patent, but he has what he calls a gauge, and the cloth with the solution upon it is passed under it, and thus the solution is spread. He carries it over steam-boxes, over heated rollers, and I do not know how else. My friend says, the trade was worth little or nothing until within a few years; that is to say, as soon as he abandoned his patent and set to work in a new way, then it became profitable. No sooner does he begin with his machinery, than he says, "now I have succeeded!" What part of the patent is he using?—he disclaims the solution. He says, "Oh! I have improved." Yes, he has, but by leaving it all out; improved upon Hamlet by leaving out Hamlet! This is a singular and a remarkable instance of a patentee coming into Court and complaining that his patent has been infringed, and yet he is carrying on his alleged *patent manufacture* by a mode wholly different from the patent. Tell me whether the pressure that is applied is the same? Tell me whether the mode of spreading the solution is the same, or whether the mode of stretching or distending (which is the word he uses) is the same? Look at the specification—there is putting it on, there is spreading, there is drying,—which of them does he follow? His machinery, I admit, may be the subject of a patent if it is new—which, for aught I know, it may be; but for a man to come into Court and to say, "Do not inquire how I am carrying it on; it is all new; it is all improvement; it is unjust that I should be obliged to disclose it!" I have never witnessed any case of a patentee attempting to shrink from disclosing how he carried on his patent manufacture. I have never witnessed an instance where a man claimed so little, and of that little continued to use still less. What is the substance of the great body of evidence here? The witnesses from the gas-works prove, that he never, except on one occasion, bought the coal-oil separately; and it slipped out from several of the witnesses, coal-tar naptha was another name for coal-oil. The chemists tell you, too, that they cannot tell how it is prepared. We have had a good deal of talk about Weisse and Clark, but I will keep off debateable ground; I shall confine my case to what I believe is unanswerable and beyond reasonable dispute. These instances of the socks, the balloons, the books, and the specifications, are all matters in which there can be no dispute; their effect is the only question; their existence cannot be denied. The evidence of the chemists and the gas people is irrelevant, because it is not part of my case to say, that in making gas, coal-oil is not produced; but I say, for some reason, it never has been collected in a separate state as an article of trade; that it has never been bought or sold in a separate state; the single instance to which I have referred, only making the deviation from the general course; and saving my friends the trouble of disputing that you may get a certain quantity—though, I believe, a quantity wholly inadequate for the purposes of the inquiry—a certain quantity of what they call coal-oil, in a state unfit for use, without undergoing further process, in a state not applicable to any useful purpose as connected with this cause, may be taken is matter of no dispute; but that that which is procured from the gas-works is applicable—that you could make a garment that any gentleman, or any person whatever could wear with any comfort, I utterly deny. The specimens you have seen have been prepared with the utmost care and caution, and the productions of science are no test as to its applicability to the general purposes of trade. Looking therefore at the extraordinary feature of the case, of a patentee not working by his own patent—looking to the details of the mode of his carrying it on compared with the simplicity of his patent, and bearing in mind, as the trade becomes valuable, what, after these alterations it will be—it is for you, as a matter of fact, to say whether or not this is new, in the sense in which it must be new, to sustain the patent. But, gentlemen, what is the remainder of the case? Mr. Macintosh uses a solution which he will not disclose; he says, "I will bring an action against Mr. Ellis, for he has made a cloak which consists of the union of two fabrics by means of the solution of India-rubber, therefore I bring an action against him." Well but, sir, your patent is for a particular mode; what is your evidence that Mr. Ellis, or Mr. Fanshaw, or whoever else is the manufacturer, what is the evidence he has used your mode? Upon the evidence, what ground is there to suspect even that Mr. Ellis or Mr. Fanshaw is in possession of the solution used by these plaintiffs? What is the evidence then, that any part of this is done in the manner in which Mr. Macintosh describes? Here is the same result, and that is all. My learned friend's argument will be this, "My witnesses guess this must be made in the same way, because they know of no other." Is that evidence for a man to bring an action upon? I say that the defendant is under no obligation to disclose what is the solution which he uses; he has asked no exclusive benefit; he has offered no price for it which he is bound to pay; no condition that he is under any obligation to perform, and the plaintiff's evidence is but a loose guess. The evidence which has been given is to this effect—I refer to Mr. Phillips's—"I cannot tell by what means the India-rubber used in the defendant's cloak was dissolved; I apprehend that the India-rubber which is found between the two folds had been dissolved, because I know of no other way in which the same effect could be produced." Now this gentleman had never heard of any of those patents—had never heard of the socks—had never heard, in fact, any thing thing about it. I deny the validity of the arguments, that because we don't show our mode, you are to presume it is theirs. There are various modes in which the thing may be done; it may be done by native juice; it may be done in a great variety of ways; but this is clear, that a knowledge of the solution of India-rubber to make it applicable to this purpose, is a most valuable secret—which the plaintiff keeps. I apprehend the specification will be found deficient, his claim being larger than he can support. I should have been glad to have seen some of the paper specimens of the union produced by the crude *oil, and to have seen experiments made with materials of a light texture*; but all the specimens that have been produced, only disprove the allegation of the specification, that the directions contained in it formed the best mode known to Mr. Macintosh; he never used the crude oil; he never will use it; it is not in a state to be used except for the purpose of experiment; you have only to apply your noses to the article, to be satisfied that it is not a marketable article.

(To be concluded next week.)

NOTES AND NOTICES.

New Railway Locomotive.—A locomotive-carriage, having a very simple engine on a new principle, is nearly completed for the Greenwich Railway Company. The frame is constructed so that the wheels cannot deviate from the rails at any speed, and that their *revolving* motion can be instantly changed to a *sliding* motion; thus the train being powerfully retarded by friction, is speedily brought to rest, and the risk of accidents to the spectators and passengers on the viaduct is materially diminished.—*Morning Herald.*

Sugar from Beet-Root.—Messrs. Fies and Havewald, of Quedlinburg, in Westphalia, have discovered a process whereby in 12 hours 10lbs. of pure sugar, perfectly crystallised, may be extracted from 100lbs. of beet-root. The secret was immediately purchased by M. Brokhoff, of Wisburg, for 20,000 francs, with the condition that it should not be used beyond the provinces of the Rhine and Westphalia.—*Ibid.*

Longitude at Sea.—The ***Progress***, a journal of Arras, states, that a person residing at Fauquembergue has, after studying for thirty years, discovered the longitude at sea, and formed an instrument which constantly points out and rectifies the ship's course, indicating the longitude and latitude in the chart.

Naval Gas-Lighting.—A steam-vessel is fitting in the river which is to be lighted with gas, on a plan suggested by Lieutenant Engledue, R. N. Two retorts are placed in the fires under the boilers about two hours before dark, which will supply gas sufficient to burn the whole night, lighting the cabins, engine-room, and mast-head. This may be fitted at a trifling expense, and without the least danger, the whole of the apparatus being on deck. Frequent accidents have occurred from steam-vessels not being properly lighted at night.

Improved Music-Stand.—M. Mayerhoper, a manufacturer of pianofortes in Utrecht, has invented an ingenious music-stand, a slight pressure with the foot on a pedal attached to which, enables the player to turn over the leaves of the book without taking the hands off the instrument.—*Dutch paper.* [Several similar inventions have been patented in England; and one, which particularly answers this description, about two years ago by a Mr. John Ramsey.]

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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HOSKING'S PORTABLE PUNCHING PRESS.

Fig. 1.

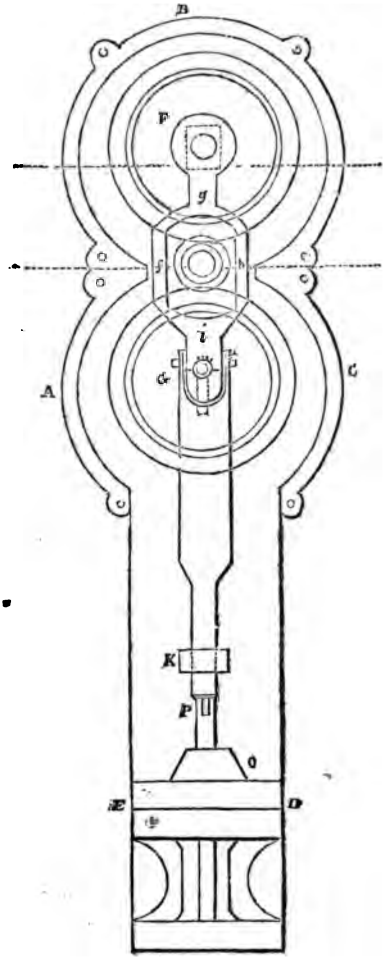
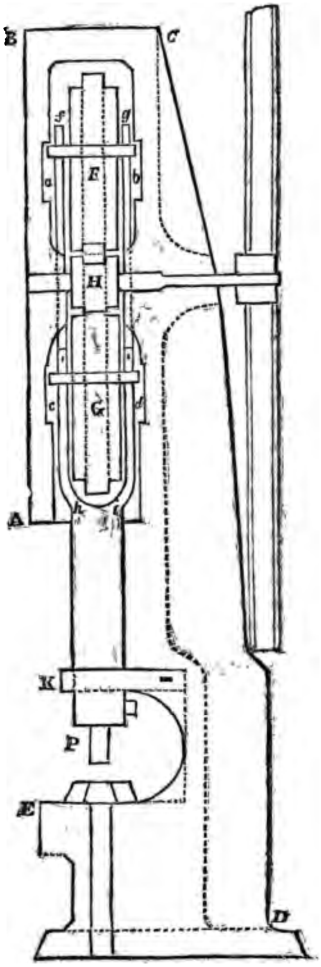


Fig. 2.



HOSKING'S PORTABLE PUNCHING PRESS.

(From the Third Report of the Cornwall Polytechnic Society.

This machine is principally intended to facilitate the repairs of steam-packet boilers; it is sufficiently compact to admit of being readily conveyed to any dock or yard where its services may be required. Figs. 1 and 2, are two vertical sections through the centre of the press, at right angles to each other, in which A B C D E, is a substantial iron frame, cast in two parts, having a space between them to contain two slightly eccentric cog-wheels F and G, whose arbors work in the wrought-iron frame *f g h i*, which is firmly connected with the punch P. These wheels are driven by the pinion H, which, like the wheels, may be said to consist of three parts; a central part containing the cogs, and two outside cylindrical portions, whose circumferences in each case coincide with the pitch lines; these, by rolling on each other, keep the cogs at a proper and uniform distance, and prevent the undue strain and irregularity of action which would otherwise attend the eccentricity of the wheels, and consequently vertical movement of their centres.

For the purpose of keeping the centres of the wheels in the same vertical plane with the centre of the punch, their arbors are continued into a groove cast in the framing, and shewn at *a b c d*, together with the guide *k*.

The action of this machine will now readily be understood. Motion being given to the fly-wheel, is communicated by the pinion of the wheels F G, which are so arranged that the longest working radius of one, and the shortest of the other, shall be in contact with the pinion at the same time; when the longest radius of the wheel G, is with the pinion, the punch will be at its greatest depression; and when this wheel has made half a revolution from that point, it will be at its greatest elevation. The material to be punched should then be placed on the stand O, and at the next half revolution of G, the piece would be forced out.

It is obvious that this machine possesses many other advantages than its portability; and we are inclined to think that in connexion with the steam-engine, *it would be found greatly superior to the screw-press generally used for this purpose.*

A POSTSCRIPT TO THE EPISTLE TO THE PHILLIPIANS.

In vol. viii. of the *Mechanics' Magazine*, p. 29, it is stated, that the proportional distance of any planet from the sun, multiplied by its square root (or the 1·5 power of the proportional distance), is equal to the periodic time of that planet in siderial years. Or inversely, the 1·5 root of the proportion of the siderial period of any planet, is equal to its proportional distance. The measures of the periodic times and distances of the planets are arbitrary numbers; as, for instance, the periodic times may be stated in their numerical proportions to each other, or they may be taken in years, days, or hours, &c. And their distances may also be given as proportional to each other, as is frequently the case, or they may be given in radii of the earth, miles, feet, &c. It is usual, however, to state the periodic times in mean solar days, and their distances in miles. Sir Richard Phillips informs us, column 296, 1st edit., that the cube root of the square of a planet's period, multiplied by 1·83, is its distance in *millions* of miles universally, or $P^{\frac{2}{3}} \times 1{\cdot}83 = D$.

Now, this is precisely the same as given above, excepting the multiplying by the factor 1·83, which gives the distance in *millions* of miles. Now, what is this factor 1·83 compounded of? Evidently of the arbitrary numbers used in the computation, viz. the *earth's* period in days, and distance from the sun in miles.

Sir Richard strenuously avoids in his computations the use of Kepler's laws and computes by what he styles his own new law; but, unfortunately, it so happens, that this factor 1·83 is derived from the very essence of Kepler's law. Now, having the periodic time given, to find the earth's distance from the sun in *miles*, we ought to extend the factor to seven places of figures, for taking the earth's siderial period at 365·2563835 days, and its mean distance from the sun equal to 94000000 miles, we get the factor as follows equal to $\sqrt[3]{\frac{94000000^3}{365{\cdot}2563835^2}} = 1839625$, *i. e.* divide the cube of the distance in miles, by the square of the periodic time in days, and the cube root of the quotient gives the factor as above stated.

Whence, to find the Earth's Distance,

$$\begin{array}{rr} 365{\cdot}2563835\text{ days} = \text{log.} & 2{\cdot}5625978 \\ & 2 \\ \cline{2-2} & \sqrt[3]{5{\cdot}1251956} \\ \cline{2-2} & 1{\cdot}7083985 \\ \text{Factor } 1839625 \quad \text{log.} & 6{\cdot}2647293 \\ \cline{2-2} \text{Distance} = 94000000\text{ miles} = & 7{\cdot}9731278 \\ \cline{2-2} \end{array}$$

Or the distance of a planet being given, we may, by inverting the process, find its periodic time by dividing by the 1·5 power of the above factor.

Example to find Jupiter's Periodic Time.

$$\begin{array}{rr} \text{Distance from the sun } 488{\cdot}908{\cdot}265\text{ miles} \ldots \text{log.} = & 8{\cdot}6892274 \\ & 3 \\ \cline{2-2} 2) & 26{\cdot}0676822 \\ \cline{2-2} & 13{\cdot}0338411 \\ \text{Factor} = \overline{1839625}^{1{\cdot}5} = 2495134000\text{ log.} & 9{\cdot}3970939 \\ \cline{2-2} \text{Periodic time} = 4332{\cdot}5851167\text{ days} & 3{\cdot}6367472 \\ \cline{2-2} \end{array}$$

The above process of Sir Richard's for finding the earth's distance from the sun, when stripped of its disguise, stands self-condemned, as this, as well as other formulas, of Sir Richard's, are evidently derived from Kepler's laws!!

J. UTTING.

Lynn Regis, March 18, 1836.

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ON THE MANUFACTURE AND USE OF SOLUBLE GLASS.

(Translated from "Traite de Chimic appliquee aux Arts, par Mr. Dumas," by James Renwick, LL. D., Professor of Nat. Exp. Philosophy and Chemistry in Columbia College, New York.)

Soluble glass is a simple silicate of potassa or soda, which unites perfect solubility in boiling water to some of the general properties of common glass: besides, although the uses to which soluble glass is applied are very different from those of common glass, the study of it will furnish such exact and close analogies to other descriptions of glass, that we are compelled to include it in the group of chemical compounds which they form.

The discovery of soluble glass and of its uses, is due to a distinguished German chemist, from whom we derive all we have to say in relation to it. This glass, when dissolved in water, forms a liquid which may be applied to cloth or wood, *for the purpose of rendering them incombustible. In fact, by* the evaporation of the water in which it is dissolved, a layer of a substance capable of fusing when heated, is deposited on these bodies, which is capable of protecting them from the contact of air necessary for their combustion.

Preparation.—Soluble glass may be obtained by dissolving pure silea, obtained by precipitation, in a boiling solution of caustic potassa; but, this process, being both inconvenient and costly, cannot be practised upon a large scale.

When sand and carbonate of potassa are heated together, the carbonic acid is never wholly driven off, except when the sand is in excess; but the whole of the carbonic acid may be expelled by adding powdered charcoal to the mixture, in such proportion that the carbonic acid of that part of the carbonate which is not decomposed may meet with a sufficient quantity of carbon to convert it into carbonic oxide. In this way the silica first forms a silicate in the proportions contained in common glass, and drives off the appropriate equivalent of carbonic acid; then, at a high heat, the rest of the carbonate of potassa is decomposed by the carbon, the carbonic oxide escapes, and the potassa, thus freed, either sublimes, or combines with the glass already formed.

In order to obtain soluble glass of good and uniform quality, certain precautions are necessary. The carbonate of potassa employed, must be purified.* If it contain much chloride of potassium, the product will not be entirely soluble in water, and a glutinous residuum will be left. In addition, the glass will be liable to effloresce. Sulphate of potassa does not produce any bad effect, because it is decomposed by the carbon, when the matter continues sufficiently long in fusion; but without this precaution, the glass will contain sulphuret of potassium, which also has a tendency to efflorescence.

The sand must be pure, or at any rate must not contain any notable proportion of lime or alumina, for these earths render a part of the glass insoluble. A small portion of oxide of iron has no influence on the qualities of the glass.

The sand and carbonate of potassa (pearl-ash) are taken in the proportion of two of the latter to three of the former, and to 10 parts of pearlash and 15 of sand, 4 parts of charcoal are added. A less portion of charcoal must not be taken; on the contrary, if the form of potash employed be not sufficiently pure, a larger proportion of charcoal may be advantageously employed. This substance accelerates the fusion of the glass, and separates from it all the carbonic acid, of which there would otherwise remain a small quantity, which would have an injurious effect.

In other respects the same precautions that are employed in the manufacture of common glass, are to be observed. The materials must be first well mixed, then fritted, and finally melted in a glass pot, until the mass becomes liquid and homogeneous. The melted matter is taken out of the pot with an iron ladle, and the pot is then filled with fresh *frit*.

Thirty pounds of pearlash, 45 of sand, and 12lbs. of powdered charcoal may be *taken for a charge*; with this quantity the heat must be continued for 5 or 6 hours.

The crude glass thus obtained is usually full of air bubbles; it is as hard as common glass, of a blackish gray colour, and transparent at the edges; sometimes it has a colour approaching to whiteness, and at others is yellowish or reddish; these are indications that the quantity of charcoal has not been sufficient.

If it be exposed for some weeks to the air, it undergoes slight changes, which rather tend to improve, than injure its qualities. It attracts a little moisture from the air which slowly penetrates its mass, without changing its aggregation or its appearance; it merely cracks, and a slight efflorescence appears at its surface. If it be exposed to heat, after it have undergone this change, it swells up, owing to the escape of the aqueous matter it has absorbed.

In order to prepare it for solution in boiling water, it must be reduced to powder by stampers; if this were not done, it would dissolve too slowly. One part of glass requires from 4 to 5 of water for its solution.

The water is first heated to ebullition in an open boiler, the powdered glass is then added by degrees, and must be continually stirred, to prevent it from adhering to the bottom. The ebullition must be continued three or four hours, until no more glass is dissolved: the liquor will then have acquired the proper degree of concentration. If the ebullition be checked before this state is attained, carbonic acid will be absorbed by the potassa from the air, which will produce an injurious effect; for the same reason, too great a quantity of water must not be employed, for during the long evaporation which will then become necessary, the carbonic acid of the water will readily combine with the potassa, and cause a precipitation of the silica.

When the liquor becomes too thick, before the whole of the glass is dissolved, boiling water must be added.

When the solution has acquired the consistence of syrup, and a density of 1.24 to 1.25, it is sufficiently concentrated and fit for use. It is then permitted to rest, in order that the insoluble parts may be deposited; while it is cooling, a coriaceous pellicle forms upon the surface, which after a time disappears of itself, or may be redissolved by depressing it in the liquor. This pellicle begins to appear during the ebullition, as the liquor approaches a state of concentration, and may even serve to indicate this state.

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* *Pearlash being the purer form, we shall use its name in the practical part.*

When the crude glass is of a proper composition, it contains but a few saline impurities, and no sulphuret of potassium it may be treated in the way we have described. But if it contain any notable proportion of these substances, they must be separated before it is dissolved; this separation may be effected in the following manner:—The powdered glass is exposed to the action of the air for three or four weeks, during which time it must be frequently stirred; and if it run into lumps, which will happen in moist weather, they must be broken up. The glass as we have stated attracts moisture from the air, and the foreign substances either separate or effloresce. It then becomes easy to remove them from the glass. It is sprinkled with water, and frequently stirred. At the end of three hours the liquor is removed, it will then contain a part of all the saline impurities, and a little of the silicate of potassa; the powder is again to be washed with fresh water. Soluble glass thus treated, readily dissolves in boiling water, and the solution leaves nothing to be desired.

As soluble glass is employed in the liquid form alone, it is kept in this state for use. To preserve it, no particular care is necessary, as even after a long space of time it undergoes no perceptible change, if the solution have been properly prepared. The only precaution is not to allow air too free an access to it.

A similar product may be obtained by using a carbonate of soda instead of one of potassa. In this case, two parts of the soda of the shops is required for one of silica. This glass has the same properties as the other, but is more valuable in its uses. The solutions of these two kinds of glass may be mixed in any proportion whatever, and this mixture is more serviceable in some cases, than either of them separately.

Properties.—Soluble glass forms a viscid solution, which when concentrated becomes turpid and opalescent; it has an alkaline taste and reaction. The solution mixes in all proportions with water. When the density of the solution is 1.25, *it contains nearly 28* per cent. of glass; if the concentration be carried beyond this point, it becomes so viscid that it may be drawn out in threads like molten glass. Finally the liquor passes to the state of a vitrious mass, whose fracture is conchoidal; it then resembles common glass, except in hardness. When the solution is applied to other bodies, it dries rapidly at common temperatures, and forms a coat like a varnish.

Soluble glass when dried, does not undergo any perceptible change when exposed to the air, and attracts from it neither moisture or carbonic acid; neither has the carbonic acid of the atmosphere any well marked action on the concentrated solution; but when a current of carbonic acid is passed through the solution, the glass is decomposed, and hydrate of silica deposited. But a weak solution becomes turbid on exposure to the air, and is after a time decomposed wholly. When the glass is impure, an efflorescence is formed after a while, which may be produced either by the carbonate and hyposulphate of potassa, or by chloride of potassium.

Soluble glass dissolves gradually without residuum in boiling water; but in cold water the solution is so slow as to have led to a belief that it does not dissolve at all. It however never becomes entirely insoluble, except when it contains a much larger proportion of silica, or when it is mixed with other bodies, such as the earths, metallic oxides, &c., with which double or triple salts are formed, as is the case in the common glasses.

Soluble glass which has been exposed to the air, and is afterwards submitted to the action of heat, swells and cracks at first, and melts with difficulty. It then loses about 12 per cent. of its weight. It therefore contains, even when solid, a considerable quantity of water, which it does not lose when simply dried by exposure to the air.

Alcohol precipitates it unaltered from its solution in water. When the solution is concentrated, but little alcohol is required for precipitation, and it need not be highly rectified. Pure soluble glass may therefore be easily obtained from an impure solution by the use of alcohol. The alcohol being added, the gelatinous precipitate is permitted to settle; the supernatant liquor is decanted, the precipitate collected, rapidly stirred after the addition of a little cold water, and subjected to pressure. In truth, however, this process is attended with some loss, for even cold water will rapidly dissolve the precipitated glass, in consequence of its minute division.

The acids decompose the solution of glass. They also act upon it when solid, separating the silica in the form of powder.

Uses.—The properties of soluble glass fit it for numerous and varied applications. It has been used in the theatre of Munich as a means of safety from fire.

All sorts of vegetable matter, wood, cotton, hemp, linen, paper, &c. are, as is well known, combustible; but in order that they shall burn, two conditions are requisite, an elevated temperature, and free contact of air, to furnish the oxygen necessary for their transformation into water and carbonic acid. When once set on fire, their own combustion develops the heat necessary to keep up the chemical action, provided they be in contact with air. If deprived of such contact, and made red hot, they will, it is true, yield inflammable volatile products, but the carbon which is left will not burn, as it is deprived of air, and thus the combustion will stop of itself. Such is the part which all the fixed fusible salts are capable of performing, if they be, in addition composed of substances incapable of yielding their oxygen at a low red heat, to either carbon or hydrogen. These salts melt as the vegetable matter becomes heated; they form upon it a coat impenetrable to the air, and either prevent altogether, or limit its combustion. The phosphate and borate of ammonia have such a character, but they are so readily soluble in cold water, as to be liable to objections which cannot be urged against soluble glass.

Although soluble glass is of itself a good preservative from fire, it fulfils the object better when it is mixed with another incombustible body in powder. In this case the solution of glass acts in the same manner as the oil of painters. The several coats have more body, become more solid, and more durable; and if the substance which is added be of proper quality, coagulate by the action of fire into a strongly adhesive crust. Clay, whiting, calcined bones, *powdered glass, &c.* may all be employed *for this purpose*; but we cannot yet say *with certainty* which of them is to be preferred. A mixture of clay and whiting, appears to be better than either used separately. Calcined bones form with soluble glass a very solid and adhesive mass. Litharge, which, with the glass, makes an easily fusible mixture, does not give a product fitted for coating wood, as the mixture contracts in drying; it therefore cracks, and is easily separated. Flint glass, and crude soluble glass, are excellent additions. The latter ought to be exposed to the air after it is pulverized, in order to attract moisture. If it be mixed with the solution, and be then applied to any body whatever, it in a short time forms a coating as hard as stone, which, if the glass be of good quality, is unalterable by exposure, and resists fire admirably.

The scoriæ of iron and lead, felspar, fluor, may all be employed with soluble glass; but experience alone can decide which of these substances is best, and in what proportion they are to be employed. We should advise that the first coat should always be a simple solution of the glass; and that a similar solution be applied over coats composed of its mixture with other substances, particularly when such a coat is uneven and rough.

The last named substances form a solid and durable coating, which suffers no change by exposure to the air, does not involve any great expense, and is readily applied. But, in order that it may not fail, particular care is to be taken both in preparing and employing it.

In order to cover wood and other bodies with it, the solution must be made of a pure glass, for otherwise it would effloresce and finally fall off. However, a small degree of impurity is not injurious, although after a few days a slight efflorescence will appear; this may be washed off by water, and will not show itself a second time. When a durable covering is to be applied to wood, too strong a solution must not be employed at first; for in this case it will not be absorbed, will not displace the air from the pores, and in consequence will not adhere strongly. It is a good plan to rub the brush several times over the same place, and not to spread the coating too lightly. For the last coats a more concentrated solution may be employed, still it must not be too thick, and must be spread as evenly as possible. Each coat must be thoroughly dry before another is applied; and this will take, in warm and dry weather, at least twenty-four hours. After two hours the coat appears to be dry, but is still in a state to be softened by laying on another. The same inconvenience will then arise, which occurs when a thick coat of a concentrated solution is applied; the coat will crack, and does not adhere. This, however, is only the case when potassa is the base of the glass, for that formed from soda does not appear to crack.

In applying soluble glass to the woodwork of the theatre at Munich, 10 per cent. of yellow clay (*ochre?*) was added. After six months, the coat had suffered but little change; it was damaged only in a few places, where it had need of some repair. This arose from a short time only having been allowed for the preparation and application of the glass, and they were therefore done without proper attention.

When this mode is employed for preserving a theatre from fire, it is not enough to cover the woodwork, it is also necessary to preserve the scenery, which is still more exposed to danger. None of the methods yet proposed for this purpose appears as advantageous as soluble glass, for it does not act on vegetable matter, and completely fills up the spaces between the thread; it fixes itself in the web, in such a way that it cannot be separated, and increases the durability of the fabric. The firmness which it gives to stuffs does not injure them for use as curtains, because it does not prevent them from being easily rolled. So far as the painting of scenes is concerned, the glass forms a good ground for the colours. To prevent the changes which some colours, Prussian blue and lake for instance, might undergo from the alkaline matter, it will be necessary before painting to apply a coat of alum, and then one of whiting.

There is no great difficulty in applying soluble glass to cloths, still this operation is not so easy as might at first be imagined. It is not sufficient to coat or dip them in the solution; they still require after this operation to be subjected to pressure. This object might perhaps be best attained by passing them between rollers plunged in the solution. When a cloth is only coated with soluble glass, is put into the fire, it will remain incandescent after it is taken out. This is not the case when it has been properly impregnated with the solution. A still better purpose is answered in this case, when litharge has been added to the solution. The stuff in drying yields to the shrinking of the mixture, and becomes inseparable from it, which is the reverse of what happens when it is applied to wood. A single part of litharge in fine powder is sufficient for fourteen parts of concentrated liquor.

Soluble glass is capable of many other applications, and particularly as a cement; for this use it is superior to all those which have hitherto been employed, for uniting broken glass, porcelain, &c.

It may be used in place of glue or isinglass in applying colours, although when employed by itself, it does not make a varnish which will preserve its transparency when in contact with air.

RESOURCES OF INDIA.

At a general meeting of the Royal Asiatic Society, held on Saturday last, the Right Hon. C. W. Williams Wynn, M.P., President, in the chair, a very important suggestion was brought to the notice of the meeting by the Right Hon. Holt Mackenzie and John Forbes Royle, Esq., having for its object the institution of a committee of trade and agriculture, through which to institute inquiries, and to establish a more perfect knowledge than at present obtains in this country, respecting the capabilities of the various soils and climates of India in the production of articles of commercial importance in the markets of England; and also respecting the transmission of good specimens of the different qualities of staple articles of commerce to the zemindars and landholders of India, with a view to stimulate them to improve similar productions of that country. A very large and well arranged collection of specimens of seeds, roots, and other vegetable and mineral productions of the East, formed by Mr. Royle, in India, was exhibited to the meeting.

The Right Hon. Mr. Mackenzie read a very ably written paper, which he had been requested to draw up on the subject of the proposed plan. He said that, although by pursuing our investigations in the proposed field of inquiry, we might not anticipate the recurrence of any such surprising effects on the commerce and general economy of the civilized world as had been followed in some memorable instances—we might not look for another root, like the potato, with which to feed millions—nor to any unused plant from which to strip leaves which should so captivate the taste of man as the tea or the tobacco,—nor find a berry that shall compete with the coffee in its beneficial qualities—still it would be strangely to misinterpret the past, if, from its fertility, we were to infer the barrenness of the future. It was justly remarked, that little is known in India of what is required here, and little is known here of what India does and can produce. On the whole, the conclusion seemed to him inevitable, that it was in the highest degree desirable that some new scheme should be instituted which should collect, digest, and combine the necessary facts in both countries; which should open to men of science new scources of information, and new channels for the diffusion of their speculations; and which should give to men of enterprise new facilities for the prompt ascertainment of all the particulars on which they may desire to be informed. This task he thought the society might with great advantage undertake, forming, as it naturally did, the recognised medium of communication between India and Europe. The gentlemen at the India-house appeared readily to recognise the benefits to be derived from the proposed plan, and their accumulated materials would doubtlessly be placed at the disposal of the society, and it might confidentially anticipate the co-operation of many gentlemen connected with this city.

Mr. Royle, after acquainting the meeting with the circumstances which led him to turn his attention to the *materia medica* of India, and to forming the collection on the table, read from his notes a very lucid detail of the manner in which the sciences, particularly those of botany and meteorology, might be applied to the acclimation of plants exotic to the country in which we would introduce them. He did not think he was too sanguine in believing that we might increase the comforts and resources of the natives of India, and give a stimulus to their internal and external commerce. That these views were not chimerical we might be convinced of by looking to the rise and progress of the trade in indigo, opium, lac, silk, cotton, and, more recently, catechu, safflower, linseed, and even rape seed. Time would not allow that he should detain the meeting with even the shortest notice of what had been done elswhere; but he could not help alluding to the cultivation of the beetroot in France, and the manufacture of sugar from it, as one of the triumphs of science. The discovery of the tea-plant in Upper Assam, would, he hoped, also be allowed to be a very strong confirmation of the theoretical views which led him to recommend its cultivation in different parts of the Himalayan mountains. In proposing, therefore that the society should investigate the productions, and inquire into the processes of cultivation in the East, and apply to their improvement the science of the West, he considered that he was taking the only satisfactory and legitimate means of attaining the object in view,—the improvement of the resources of India.

The thanks of the meeting were unanimously voted to the Right Hon. Mr. Mackenzie and Mr. Royle, for their valuable communications.—*Times*.

We earnestly hope that the patriotic plans so ably developed by Messrs. Mackenzie and Royle, in the papers, of which the above is an extract, will not be lost sight of, but matured and carried into effect with the least delay possible. The true way to make India valuable to England, is not to exact money-tribute from her (which would only be to make her every year poorer and poorer, till at length she would not be worth the keeping), but to do all we can to promote the cultivation of her internal resources—to make her rich in exchangeable articles, in order that she may be the better able to buy from us the multifarious products of our superior manufacturing skill—to merge, in short, all ideas of conquest and dependence in a perfect reciprocity of advantages. To show how suitable the climate and soil of India are for the production of articles of the first European necessity, and, at the same time, how much its natural capabilities have been hitherto neglected, we subjoin an extract from Mr. Royle's admirable work on the botany of the Himalayan mountains, in relation to the article tobacco: it contains some curious and interesting details:—

"East-India tobacco holds the lowest place in the English market, and is described as being too high dried, or as all stalk and powder, fit only for the inferior kinds of snuff, or for re-exportation. The inconveniences of this are not so much experienced in India as elsewhere, for both natives and Europeans use the tobacco for their hooqqas, only when beat up with molasses, conserves, and spices.

"That it is not owing to any inherent defect in the climate of the British possessions in India, that the tobacco is of such inferior quality, I am happy to be able to prove by extracts from official documents, with which, owing to his kindness and anxiety to assist in improving the resources of India, I have been favoured by Mr. William Johnson, of the East-India House. First, with respect to that which obtained considerable repute under the name of Martaban tobacco, Dr. Wallich states, that 'the sort is from Arracan and not from Martaban;' and describes it as having 'a fine silky leaf: tried by many people, it had been pronounced the very best they had ever tasted, equal to, nay, surpassing the finest imported from Turkey and Persia.' An extensive tobacconist says, 'a finer and better flavoured tobacco he never saw or tasted in his life.' One of the first brokers in the city says, 'the sample of leaf tobacco is certainly of a very fine quality, and appears to have been produced from some peculiar seed, and a greatly improved cultivation and cure.' By many manufacturers 'it was supposed to be from the seed of Havannah or St. Domingo tobacco.' For smoking, it is compared with Maryland tobacco, having the same qualities, 'except the flavour, which is better, and more like Havannah.' The colour and leaf are moreover pronounced excellent for cigar-making; 'but if any thing is against it for that purpose, it is the largeness of the principal stalk, and coarseness of the small fibres in the leaf.' The commercial gentleman by whom the tobacco was transmitted to the brokers, pronounces it very superior, and the leaf as very fine, adding, that the price of 6*d*. or 8*d*. might readily be obtained, perhaps more, with the improvements suggested.

"As it is interesting, if possible, to ascertain the peculiarities of climate and country where so superior an article is grown, we have a communication from Mr. R. Hunter, the gentleman who brought the tobacco from Arracan, who states that 'the Sandoune tobacco grows on the sloping banks of rivers not overflowed while the crop is on the ground, but inundated during the rains. The best is that grown above the influence of the tides, about *thirty miles* from the mouth of the river. The ground receives apparently great attention in cleaning and in breaking the clods. The tobacco is all transplanted about November, and the crops are cut about March.' Here we see the coldest season is selected for the cultivation: with respect to climate, it may be inferred, from the province of Arracan extending along the western side of the Bay of Bengal, and included between the coast and a range of mountains, that it must have alternations of temperature, and of land and sea breezes; and that though Arracan Proper is low, inundated, and shut in by low hills, at Bassein the climate is described as neither oppressive nor unhealthy from November to May (Encl. Met. Pegu), and Sandoway as mountainous, and not subject to inundations, enjoying a cool sea breeze, and temperate nights nearly through the year. It is, however, probable, that the superiority of the tobacco is owing to careful cultivation and cure. This was probably taught by Europeans, as Arracan was the seat of a Roman Catholic mission in the beginning of the seventeenth century. It is pleasing to find here, as in the vicinity of Ormuz, the arts continuing to benefit a country long after the conquests of those who introduced them have passed away.

"Of other tobaccos which have some repute in India, Dr. Ainslie states, that 'the finest kinds in India, and perhaps in the world, is grown near the village of Woodanum, in the Northern Circars,' 'and in some of those low sandy islands formed at the mouth of the river Krishna (from which is made the famous Masulipatam snuff); also in the Delta of the Godavery, where the soil is peculiarly rich and fertile.' Dr. Wallich, in his evidence before the Committee of the House of Commons, states that some excellent tobacco was grown at Boglipore, from Havannah seed, and that some very esteemed kind is grown in Bundelcund. The tobacco of Chunar is celebrated in India, as is more especially that of Bhilsa, of which a great portion, I am informed by Dr. Moore, is sent away in presents by the Raja of Nagpore. It is to be regretted that we are unable to ascertain the commercial value of any of these, as they do not appear to have been sent to the English market. The only exception is that mentioned by Mr. Ritchie, of one bale of the fine tobacco grown in the northern districts of Bombay selling for 6*d*., while American sold for 5*d*.; but the average of the experimental exportation being found defective in the curing, sold only for 1*d*. and 2*d*., and did not pay, as is frequently the case with importations of tobacco from Bengal and Bombay.

"Such appears to have been the state of the ordinary Indian tobacco, when the East-India Company determined on endeavouring to induce cultivators to improve the culture of tobacco by importing seed from Maryland and Virginia, which was to be freely distributed to those inclined to make experiments on the subject.

"These experiments, I regret to say, seem, with one exception, to have been undertaken only in the southern parts of India; at least it is from thence only that samples have been sent to the India House. Importing seed from 35° to 40°, and with territory from 8° to 32° of North latitude, elevated from 0 to 13,000 feet above the sea, it is greatly to be lamented that experimenters should have been confined to between 12° and 1°, that is, to the districts of Cuddapah, Guntoor, and Coimbatore. The object being to get an article similar in properties to that already esteemed in the market, the plan would be to make the first attempts, as failure is so apt to discourage, in the soil and climate most like that whence seed is procured. Though the above districts may by a different treatment be enabled to grow very good tobacco, there is no doubt that the soil was either too rich for the Virginia seed, or the climate too moist and warm, or perhaps both conjoined; for the plants have grown so luxuriantly, that the stalks and fibres have attained a size and coarseness, fitting them better for twisting into cables than for putting into a pipe. One cultivator, indeed, states that the plants grew so well, as to be twice the size of the country plants. The tobacco was besides so badly packed, and worse cured, that the brokers describe the different samples as 'too dark in colour,'—'thick and coarse grown,'—'nearly all stalk;'—and when the leaf is well grown, it is pronounced 'over large, with a thick coarse stalk,'—'unpleasant or musty in flavour,'—'worm-eaten,'—'not properly cured,'—'packed in a damp state,'—and that, as articles of commerce, they are 'not marketable,'—or 'of no value;'—and of the best it was said, that some tobacco from Holland of much better quality, had been sold under 2*d*. per pound.

"These facts are sufficiently discouraging, and were it not for the author's confidence, that they are the necessary result of inattention to principles, it might perhaps be considered more prudent to withhold them when recommending a new culture. But as others might commit the same mistakes, it is proper at once to meet the difficulty, that we may at the same time suggest a remedy. Besides, the tobacco of Arracan and that from Bombay has shown that, even without the aid of foreign seed, some of very superior quality may be grown in India; while the following facts prove that, by careful management, Virginia seed may be made to *yield a good crop, even* in the rich soil and *climate of Bengal.* This tobacco was imported in the Sir T. Munro, and produced from Virginia seed sown in the garden of the Agricultural Society of Calcutta: 'the method pursued in its cultivation and preservation is that generally adopted by the Americans.' This specimen was submitted by the Court of Directors to the examination of some dealers and manufacturers in London, who pronounced it to be 'the best sample of Indian tobacco they had ever seen.' In flavour and general appearance of the leaf, it approaches the descriptions which are usually selected here for manufacturing into cigars, and for smoking in a pipe, *viz*, Havannah, St. Domingo, and Ameersforth (Dutch): all of which command high prices in relation to other kinds of leaf tobacco. A portion of this sample has been made into cigars here, which are much approved; and it is probable that if a moderate supply of tabacco of the like quality were in this market, it might be in some request for making into cigars, and would come into competition with the tobacco of St. Domingo, which is at presentt worth from 6d. to 8d. per pound in bond."

"The successful result of this experiment will, it is hoped, remove any unfavourable impression produced by the former, and prove, as might be inferred indeed, from the Arracan and Bombay samples, that there is nothing in the climate of India unfavourable to the production of good tobacco, when it is attempted with careful treatment in a good climate. The more temperate climate of N. America, and the modified one of tropical situations, is attained in India by the cultivation being commenced in the cold weather, and the spring temperature equalling the summer one of more northern climates is sufficient to bring it to perfection. That it may also be grown of a superior quality in more southern provinces, is very probable, for it is not a puny seedling which is to be nursed into healthful existence, but the gross-feeding weed, luxuriating in rankness, which is to be reduced to more moderate dimensions, and starved into fineness—objects easily affected by a less rich nourishment, and a drier and more open atmosphere, both attainable in poorer, though good soils, or the more elevated parts of the Peninsula, and in many parts of India, as along the banks of the Ganges, as well as in Tirhoot, Rohilcund, and the Doab; and across India, in Bundelcund, Malwa, and the northern provinces of the Bombay Presidency. Success will still depend upon the skill of the agriculturist, in suiting the richness of his soil to the dryness of his climate, diminishing the former in proportion to the moisture of the latter, though it is doubtful whether as fine tobacco can be grown in a moist as in a dry climate. It must be remembered, that the present excellence of American tobacco is not the spontaneous effusion of the soil, but the result of the unwearied attention of both the Government and cultivators to the improvement of its produce; for some of the American planters seemed to think in former times, as Indian zumeendars appear to do at the present day, that '*any thing was good enough for the merchants*.' (Tatham, p. 141.) The Government, jealous of the good name of Virginian produce, issued rules for checking over-luxuriance, and appointed officers to see them enforced, as well as for rooting up inferior plants: while every hogshead of prepared tobacco was taken to Government warehouses, to be inspected by competent officers before it could be exported; and all of an inferior quality condemned to be burnt. (Tatham, p. 69—106; and 138, 207.)

"It is unnecessary to dilate on the cultivation and cure, as these are detailed in the instructions sent out to India by the Court of Directors, in 1819, and may be seen fully described in works easily procurable; as *Loudon's Encyclopedia of Agriculture*, which gives, in an excellent article, the cultivation in a variety of places; and '*The Tropical Agriculturist*,'' which includes the most valuable portions of 'Tatham's Essay on Tobacco,' as well as the cultivation of Shiraz tobacco, from the Hort. Trans. v. 1. n. s. p. 205: it is hoped that the remarks in this article on the necessity of paying attention to the strangely-neglected subject of climate will not be without their use. It must never be lost sight of, that the Americans pay equal care and attention to the soil, the seedling nursery, the transplanting, earthing up, keeping the ground clear, removing inferior leaves and side shoots, topping so as to leave only eight to ten leaves on each plant, airing, fermenting, drying, prizing, and packing. It is to be wished, that the effects of good culture and careful curing should be tried upon seed produced from Bhilsa, Arracan, &c., as well as upon that of foreign growth, but at first in situations as similar as possible to to them, in climate, soil, and production. This, however, can be hoped for to any extent only, when more attention is paid to inferences to be deduced from a comparison of scientific data; for the empirical attempts of purely practical people, though sometimes attended with success, are as frequently followed by failure. It is to be hoped that my friend Mr. James Princep, will persevere in getting good accounts of the climate in every part of India; and it is to be wished that good specimens of colonial produce could be sent to the several parts of India, so that cultivators might get an idea of what they had *to rival*, as well as of the prices which would reward their successful exertions.*

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LLOYDS'.

The times have arrived when every institution of the country is fated to undergo the most searching scrutiny, and when monopolies and societies injurious to the general welfare must be swept away, however they may heretofore have been enveloped in mystery, fostered by inveterate prejudice, or upheld by power. Amongst institutions of that description, which have lately been exposed to public view in treatises, reviews, magazines, pamphlets, journals, the daily press, and petitions to Parliament, is that of Lloyds'. Although the effects of this institution are to be condemned, we do not mean to reflect on the members composing it, individually. Wherever money is to be got, mankind will assemble, exactly as armies and navies are provided with men, who never trouble their heads for a moment about the cause in which they are engaged. From the exposures which have lately been made, it can no longer be concealed that Lloyds' flourishes as an institution by the wreck of ships, and the waste and destruction of merchandise in the sea. It is certain, also, that effective measures are taken to insure wrecks and waste of property taking place; and, in short, it is clearly demonstrated, not only, that were there no wrecks, there would be no sea insurances but that to multiply losses at sea, as it is the means by which underwriters derive their living, however incredible it may at first sight appear, is the underwriters' great aim. This arises from the fact, that underwriters, although apparently the insurers, are not so in reality, since they have previously derived the means of paying for any losses which may take place, from the merchant and shipowner, who again charge it to the public in the freight and charges of conveyance of merchandise; and thus the public, and not the underwriters, as is generally supposed, are the real *insurers*. It is further demonstrated that the greater the number of wrecks and waste of property, as a matter of course, the higher the premiums of insurance rise, and the better for the underwriters, and that human life is recklessly sacrificed to this system, to an appalling and incredible extent. But it is clearly impossible that such an institution can continue to exist on the present plan, after public attention has been successfully directed to it. So long, indeed, as it was enveloped in mystery, it might continue to flourish; but the exposures which have lately been made, and are still making, and above all, the strong and striking contrast proved to exist in the safety of our ships of war, which is clearly traceable to their superior construction alone, over our merchant ships, proves the mischief arising from such an institution; and it will be in vain to attempt to defend it by any appeals to the wisdom of antiquity, or denouncements of the dangers of innovation.

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* Having sent the foregoing remarks to Mr. W. Johnson for perusal, he has been good enough to send me the gratifying intelligence, while the previous sheet is passing through the press, as a 'strong corroboration of my views respecting the capabilities of the country,' that tobacco has actually arrived from India, and been sold in the London market for 8d. a-pound.

We regret to add, that there has been an indisposition on the part of government to forward inquiry on this momentous subject; and a periodical, expressly devoted to maritime subjects, and ably conducted, states that the most influential prints of the day have shrunk from a discussion of the principles of marine insurances, as now conducted. Yet, against every opposition, from whatever cause proceeding, so strong is truth, that a conviction is gradually forcing itself on all classes of society, that a monstrous abuse exists, and which must speedily be reformed. The many and powerful interests, however, deeply involved in the present system, and which have, in the course of years, grown with its growth, and strengthened with its strength, will make the reform a work of difficulty. Publicity is unfortunately effected with difficulty, and not without expense; and the public, the party really interested in the matter, is in complete ignorance of the practises. Ship-building, wherein we consider nearly the whole evil to lie, is an art almost totally unknown to the public, and in which, unfortunately, it considers itself to have little or no interest, thinking that safe ships must be *an object to shipowners*, and that they *(shipowners)* will insist on ship-builders making them safe; and, not seeing the case in its true light, that the cheaper a shipowner can get a ship, the less interest of capital he lies out of, and the less insurance he has to pay, in proportion to the cheapness, and that as he keeps his vessel fully insured, and in general the freight also, he does not care a straw about safety, or whether his vessel be lost or not. This is the real state of the case, and as the merchant can cover, not only the value of his goods, but also a profit on them by insurance, he is in much the same situation as the shipowner; while to the shipbuilder, the loss of every vessel is clearly a demand for him to build another, and the whole loss of vessels and merchandise must, in spite of all pretences to the contrary, fall on the consumer, or in other words the public. But the numerous wrecks of merchant vessels, and drownings consequent thereon, more particularly of emigrants and convicts, of late, is awakening the public from its lethargy, and the safety of vessels of war, in similar circumstances, has become indisputable. The *Pique* frigate, *Racer* brig, and *Lightning* steamer, are strong proofs of this, when compared with the *Amphitrite*, *George the Third*, and *Neva* convict ships, to say nothing of the scores of emigrant and timber laden ships, lost every season, with the emigrants, crews, and contents. When, too, it is considered that, whilst every other art and science has been rapidly improving and attaining to perfection in Britain, and ship-building in the royal dock-yards has been keeping pace with these improvements, merchant shipbuilding has positively been retrograding, and that this fact is proved, by the circumstance of shipwrecks having been greater *per cent.* of all classes of merchant vessels of late years than they were at the beginning of this century, not a doubt can exist that merchant shipping lies under some incubus, or is under some malignant influence, to which other things are not subjected. Where this influence does not exist, as in the case of the Royal Navy, safe vessels are built, which are seldom lost, even in the most exposed situations. The test of the use of an engine, is the working of the machinery; and as by the present system of classification of merchant shipping, all motive is taken from a shipowner to have a strong, safe, and durable ship, so none are built. If a law were passed that all carts should become unprofitable to the owners at eight, ten, or twelve years old, none would be made to last longer than these periods. The parallel holds exactly with merchant shipping, and this practice, together with the incompetency of the masters and mates, are the real causes of the vast majority of shipwrecks. Reform in both these respects, however, will be strenuously opposed by underwriters, together with all measures tending to a diminution of wrecks. Our limits will not admit of entering further on this subject at present, and we may give a few facts in a future number; meanwhile, able articles on the subject will be found in the *Edinburgh* and *Westminster Reviews*, the *Nautical*, *Metropolitan*, and *Tait's Magazines*, the *United Service Journal*, the *Christian Physician*, the *Spectator*, *Examiner*, and *Atlas*, and a host of newspapers. We have heard of lectures being about to be given on the subject to the inhabitants of large towns, and we believe something of the kind is already commenced in London. We feel convinced that, the impulse once given, it will go on increasing, until the object so much to be desired, as it affects the safety of human life and the national property, shall be fully accomplished. We wish it God speed!

L.

ELECTRICAL SHOCK FROM A SHEET OF PAPER.

Place an iron japanned tea tray on a dry, clean beaker-glass, then take a sheet of foolscap writing-paper, and hold it close to the fire until all its hygrometric moisture is dissipated, but not so as to scorch it; in this state it is one of the finest electrics we have. Hold one end down on a table with the finger and thumb, and give it about a dozen strokes with a large piece of India-rubber from the left to the right, beginning at the top. Now take it up by two of the corners and bring it over the tray, and it will fall down on it like a stone; if one finger be now brought under the tray, a sensible shock will be felt. Now lay a *needle on the tray with its point projecting outwards, remove the paper*, and a star sign of the negative electricity will be seen; return the paper, and the positive brush will appear. In fact, it forms a very good extemporaneous electrophorus, which will give a spark an inch long, and strong enough to set fire to some combustible bodies, and to exhibit all the electric phenomena not requiring coated surfaces. If four beaker-glasses are placed on the floor, and a book laid on them, a person may stand on them insulated; if he then holds the tray vertically, the paper will adhere strongly to it, and sparks may be drawn from any part of his body, or he may draw sparks from any other person, as the case may be; or he may set fire to some inflammable bodies by touching them with a piece of ice.

I beg to remain,
Yours, &c.
G. DAKIN.

Oxford, March 20, 1836.

THE BRITISH MUSEUM.

Sir,—In the letter on "Provincial Museums and District Institutions," which appeared in your last number, the writer is very indignant at an assertion, which it seems has been made by Mr. Forshall, secretary to the British Museum, that "very few scientific institutions exist among us which can be said to have a *permanent and public character*." He declares, however, that he will not bestow a single comment upon the ignorance displayed in this remark, which he considers too palpable to stand in need of exposure. I cannot but regret this determination on the part of your correspondent; as, however shameful it may be, I cannot but confess that I am in the same state of ignorance as the Rev. Mr. Forshall. That there are scientific institutions in existence among us, thick and threefold, is what every one must be aware of; but, as most of them are solely dependent on the fluctuating contributions of the members for their support, they can hardly be said to be permanent; and, as they are only open to members, and such friends as they have the privilege of admitting, they can still less be said to be public. It would, I suppose, hardly be considered reasonable for the British Museum to send duplicates of valuable curiosities purchased at the public expense, to the Mechanics' Institution in Southampton-buildings, or any similar establishment, in town or out of it, to contribute to the private gratification of the select few who have admission within the walls. As I cannot for an instant imagine that your correspondent could mean to suggest such a measure as this, I am led to conclude that, from some particular sources of information, unfortunately closed to readers in general, he has acquired a knowledge of the existence of several scientific institutions of a really public and really permanent character, with which he erroneously supposes every body else to be as well acquainted as he is himself. Perhaps he will have the goodness, in a future communication, to dispel the ignorance on this subject, in which most certainly many persons besides the Rev. Mr. Forshall are involved. It is possible that unless this is done, some of your readers may think the very animated exhortations of S. S., for (apparently) ordinary Mechanics' Institutes, and "all that sort of thing," to begin forthwith petitioning Parliament for a share in a general scramble of the Museum duplicates, quite as absurd as any thing that has been said by the secretary to the British Museum.

In another part of his letter, your correspondent expresses himself exceedingly astonished at a remark hazarded by one of the Museum officers, that "a small cabinet of coins could be of no advantage to a local institution." Will he allow me to ask him if this remark is made in the unqualified manner in which he gives it. Not having the report at hand, I cannot ascertain just at present whether this is the case; but I have a strong impression that it is explained, that a small cabinet *formed of such coins as are usually disposed of at the duplicate sales of the Museum*, is the sort of one referred to; that is, a cabinet formed of a number of heterogeneous coins, in no kind of series. I *know* that a similar cause is adduced for the opinion that a large portion of the books which were sold a few years ago, would be of little use to any local or district library. It is stated that many of them were obsolete mathematical and scientific works, such as were only worthy of being preserved anywhere for the purpose of illustrating *the history of science*—such as would, of *course, do more* harm than good in the *way of instruction*, if they were to fall into the hands of those who had no access to other works. Ought not S.S. to have mentioned this?

S.S. concludes his letter with a very flaming panegyric on Benjamin Hawes, Esq., the hon. member for Lambeth, where unwearied perseverance, as well as his extraordinary tact and discrimination are to well known to need any eulogium, although they get one, and are "far beyond the writer's feeble praise." If this is feeble praise, it would be curious to see a specimen of S. S.'s vehement puffing; I must own that here, again, I am in a woful state of ignorance. Though Mr. Hawes's tact in eliciting information from witnesses is, it appears, so remarkably well known, I do not know even how the public mind became aware of it. In the report of the evidence in the Museum, it is not stated who proposes the questions, although in some cases it would be as interesting to know who puts as who answers them. Some of them are very silly and some are very ingenious; and, from their bearing, it might be supposed that the hon. member for Lambeth was quite as likely to put the silly ones as the others. The only occasion on which Mr. Hawes's name comes forward with any prominence, is in the investigation of the case of Mr. Millard, who appears to have been under the patronage of Mr. H., and whose dismissal, may perhaps, have been the primary cause of the whole investigation. To whatever motives, however, the appointment of the committee may have had its origin, it appears likely to be in the end productive of much good. Mr. Hawes, likewise, it was who brought forward the question of the resumption of the Thames Tunnel; and though, perhaps, it might have been wished that some other member had taken up the affair, than one who was a large shareholder and the engineer's son-in-law into the bargain, yet, as the old proverb says, "all's well that end well."

As I have the pen in hand, I cannot conclude without remarking that, in a former number, you gave insertion to some severe strictures on the conduct of the trustees of the Museum, who purchased Mr. Hawkins's mineralogical collection, which are not, I think, borne out by the facts. The trustees, it appears, did consult Mr. König, their own superintendent of the mineralogical department, before the purchase was concluded, although not so early as he thinks they should have done, and as, perhaps, they ought. But, previous to this, they had applied to several eminent mineralogists, among others the Rev. Mr. Buckland, for their opinion on the merits of the collection, which was decidedly favourable. Now if, as has been suggested, the trustees were all to be selected from among men of high scientific attainments, who so likely to be chosen for the superintendent of the fossil department, as Mr. Buckland himself; and, in that case, what more satisfaction would the public derive from having such a purchase made by Mr. Buckland, as trustee, than by the present trustees, acting under Mr. Buckland's advice. The circumstance of the defective state of this collection has been made use of as a strong argument against the present mode of choosing the trustees; but the other circumstance of their having consulted eminent mineralogists before making the purchase, appears to me to render it wholly nugatory. Mr. Brown, the eminent botanist, was mentioned, it may be added, in an early part of the investigation, as one of those who ought to be placed on the board of trustees, if the establishment were properly managed; and Mr. Brown himself, when subsequently examined, declared his conviction, that any change in the manner of appointing the trustee would only be for the worse.

Allow me to add my recommendation to that of S. S., of Mr. Edward Edwards's pamphlet. In running through it, I have observed several trifling inaccuracies; some of the works, for instance, which he mentions as not in the Museum library, are in reality to be found there: and I do not agree with him in all of his remarks; but there can be no question that he treats the subject in general in an animated but unexaggerated and sensible manner, and throws out several observations highly worthy of attention. His little pamphlet should have an extensive circulation, and if it find its way, as I hope it will, into the hands of every Member of Parliament and influential person, may effect no ordinary share of good.

Yours, &c.
P. P. C. R.

March 29, 1836.

GRAY'S GOLDEN RAILWAY RULES.*

1. That as wasteful expenditure and want of skill are the characteristic features both of the construction and direction of all our common turnpike roads and canals, so are the opposite extremes, of economy and skill combined, alike descriptive of the railway.

2. That a National Railway Board should be established by Government in London; to direct and control the management of all Railway Companies, and to determine the proper construction of railways, so as to promote facility and economy in the dispatch and conveyance of all commodities, as well as of passengers and correspondence.†

3. That by the establishment of grand trunk railways, to run in a perfectly direct line from London to each extremity of Great Britain, and from Dublin to each extremity of Ireland, the distance between the capitals and the manufacturing districts and principal cities might be reduced one quarter, instead of the ridiculously winding course which all stage and mail coaches now daily run.‡

4. That every deviation from the straight line is a direct invitation to, and the strongest argument in favour of, an opposition company, who will soon follow that course, which common-sense would always dictate; and that nothing but the impossibility of being able to do without

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* From the respect which is due to Mr. Gray, as one of the first promoters and most constant advocates of the railway system, we feel called upon to give insertion to these Rules; but the notes subjoined will show that there are several of them to which we by no means subscribe.—Ed. M. M.

† A very questionable proposition. There is nothing from which there is more to be feared in an empire of the increasing magnitude of Great Britain, than an augmentation of the power of the Government. The centralisation system, if followed out to the extent desired for by such advocates as the author of these Rules, would be the grave of British liberty.—Ed. M. M.

‡ Why "ridiculously winding?" Is it the fault of the stage and mail coaches that towns and villages lie so seldom in a straight line? We have read somewhere of an Irish priest, who, in descanting on the kindness of Providence, gave, as a remarkable exemplification of it, that the largest rivers had been made to flow close by the largest towns; but Mr. Gray beats an Irish priest hollow—he is angry with the stage and mail coaches employed in conveying passengers from one town to another, for not steering us as clear of the said towns as possible.—Ed. M. M.

tunnels and inclined planes can be advanced in their support.[*]

5. That had the Liverpool and Manchester Railway been constructed on the cog and plain railway system, united in the same rails (plain rails for speed, and toothed rails for heavy burdens), the revenue thereof would have been threefold, whilst the expenditure might have been considerably reduced, as the cog railway system will always convey three times the burden of plain rails.[†]

6. That assuming the average freight of boats on canals at thirty tons each, it would be found that each locomotive-engine might effect as much every day as a boat in four days, or as four boats in one day, and that by the cog railway system the expense might always be one-half that of the canal.

7. That whatever improvements may take place in mechanical power, they never can be rendered available to canals, as the necessity of locks precludes *in toto* all possibility of constant, regular, or rapid communication.

8. That the transport or conveyance of merchandise of every denomination—cattle and live-stock of every kind—will be found of infinitely more importance, in a national point of view, than the mere conveyance of passengers and correspondence.[‡]

9. That as time and money are equivalent, or bear a relative value in all mercantile affairs, the unnecessary waste of either is alike reprehensible; therefore, in order to economise both as much as possible, a careful and particular examination of the system now in practice, compared with the present plan, becomes indispensable, nay, even imperative, for the welfare of the community.

10. That on taking a survey, the preliminary step towards the formation of every railway, it will eventually be found most economical, as regards our daily commerce and intercourse, to preserve one perfect level, from one extremity of the kingdom to another, as much as possible; the inequalities of the surface would be easily made up by due attention, in taking the proper levels at each extremity of the line of every railway; if we contemplate the power of locomotive steam-engines, which is to enable us daily to remove millions of tons of merchandise along railways, we surely cannot be at a loss to remove mountains into valleys by temporary railways, and thereby make one uniform level throughout.

11. That no expense which may be incurred by forming the grand trunks in direct lines and perfect levels could be felt, when we reckon the revenue to arise from the conveyance of millions of tons of merchandise. Live-stock of every description, as well as innumerable vehicles for the daily convenience of passengers, which this improved method of internal communication would annually circulate through the very heart of the kingdom, in each direction.[*]

12. That in the execution of this plan, and its general tendency in every town and village, we find profitable employment for the poor for many years, if not for ages to come, both in Great Britain and Ireland; and on its completion, by having superseded the general necessity of animal power, we release millions of acres now required for the production of food for horses, and thereby gain an accession of territory, as effectually as if taken from the sea, and in extent equal to the support of our present population.

THOMAS GRAY.

Exeter, March 28, 1836.

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[*] The argument for the perfectly straight line resolves itself into this, that the two *extreme* points of every line are alone to be taken into account, but "common-sense" repudiates all extremes.—Ed. M. M.

[†] A *cog* railway can only stand a comparison with a plain railway in the case of a steeply-inclined plane like the Sutton—where such an artificial mode of grip is wanted to counteract the sliding effects of gravity; but to represent it as being generally superior to the plain rail, is a manifest error.—Ed. M.M.

[‡] Contrary to general opinion, and demonstrably erroneous. A ton of human passengers will, in *every point of view*, be always of incalculably more *importance than* a ton of any other commodity *whatever.—Ed. M. M.*

[*] The question which is at issue, is here begged altogether; and what is worse, not fairly begged. It is this simply: By which plan—the straight or the circuitous—will the fewest miles of railway be required to meet the demands of the existing traffic of the county? We advocate the latter because it is as plain as that two and two make four, that the circuitous way is, generally speaking, and for all practical purposes, the shortest.—Ed. M.M.

COURT OF COMMON PLEAS, GUILDHALL, 25TH FEB., 1836.

Before Lord Chief Justice Tindal, and a Special Jury.

MACINTOSH *v.* EVERINGTON.

(Concluded from p. 512.)

Evidence for the Defendants.

Mr. Stephens, examined by Mr. Rotch.

I am a draper at Bridport. In 1821, I purchased two dozen socks, composed of two linings of cloth, and India-rubber between them; they were publicly offered for sale.

Mr. Attorney-General, by permission of the defendants' Counsel, stripped the cloth off both sides of the India-rubber in the sock produced; he then handed to the Jury one of Mr. Stephens's socks, and one of the plaintiffs,—" Be so good, gentlemen, as to look at that which has had the cloth torn off from each side of the plate of India-rubber, and compare it with the thin and flexible one of Macintosh's.

Mr. William Hull, examined by Mr. Gurney.

I am a glover in Wood-street, Cheapside. (*The socks were handed to the witness.*) I had in my shop in 1822, socks of this description; and by reference to my stock-book, I find I had small quantities at various times, five, ten, or twelve dozen at a time; it was an article of sale, but I think more in the hands of Messrs. Nalder and Co.

Mr. Green, examined by Mr. Serjeant Talfourd.

I have been in the habit of making balloons for a great number of years, solely under my own superintendence and that of my son. My first ascent was in the year 1821. I manufactured miniature balloons before that. The upper part of a balloon should be flexible. I made it sufficiently air-tight and water-proof by forming it of a double and treble texture, with a solution of India-rubber; some parts were double, and other parts treble. I have a miniature fac-simile of the top of that balloon. The flexible cement for uniting this substance I formed entirely of India-rubber dissolved in oil of turpentine. I used the cement which I have mentioned in forming the seams of the balloon; it was made and exhibited in the Pantheon, in Oxford-street, for months, without a stitch being put into it; it depended only on the seams which held it together. Where the surface was sufficiently large I strained it on frames, which was the case in varnishing all the silk. I used an instrument for the purpose of varnishing my balloon; I coated over the surface uniformly, and when the moisture and oil had been sufficiently evaporated, so as to become *adhesive, or nearly dried*, I applied a second coating of the solution in the same way; and a third also, in proportion to the porous state of the silk; and probably a fourth. Having in that manner prepared that piece of silk, I took another piece of silk of the same dimensions, and went through the same process, distending that and coating it over in the same way; I considered it completed then for uniting, if it was sufficiently adhesive. If it had got too dry, from the heat of the atmosphere in summer time, I have been compelled to moisten the surface of the varnish with oil of turpentine before I coated it. Many superficial feet were double and treble, not less than 40 feet at the top and 20 feet at the bottom, where extra strength is required. The bulk of the balloon consisted of silk, which is only single, but not with this coating upon it; that cement did not form the varnish; the varnish is a separate thing from the cement which unites it together—it is very differently prepared. I united the pieces of silk where they were double or treble by pressure only. I found by that means they became one substance firmly united, making the balloon air-proof or gas-proof. In addition to that we always varnish the whole balloon after; it has a polished surface, in order that any shower of rain may clean it. Since the time when I made that balloon, in 1821, I have made two others. I made miniature balloons from a boy, but I made some of a double texture for at least twenty-five years; during that time I have employed a flexible cement. I never had occasion to vary the process in the least. I believe no person except myself ever succeeded in making a perfect solution with oil of turpentine and India-rubber. The miniature balloons were exposed publicly for sale in my shop; they were not all made on the same principle. The peculiarity of the large balloon was being manufactured without stitching, with a cement formed as described; there was some little difference where the seams were; they were united with that substance, but there was an additional substance in it in order to prepare the surface to receive it, because it does not adhere so well on a smooth surface as upon those which are not smooth. This phial contains some of the solution prepared by me [*a very thin solution of the white India-rubber, such as the shoemaker's make*]. In May, 1822, I constructed another balloon on the same principle. When the coronation-balloon was exhibited at the Pantheon, I attended for the purpose of explaining its construction. I did not force it on them, because it was not a productive exhibition; but still if any ingenious persons, who had been making an experiment, had come to me and asked, I should have answered them satisfactorily. I did not tell the cement I used, or how I did it. The description of pipes I use for the purpose of carrying the gas from the main to the balloon, are of silk or linen; that is a very imperfect sample there [*referring to specimen*]—that has been lying about. All the remains of the coronation-balloon, which was destroyed in the sea off Beachy Head, I applied for that purpose which were at all applicable to it. The other fragments of the balloon that were not used for pipes, I had cut part of it into very large pieces; and before I discovered that they were useful for that purpose, I used them to throw over my shoulders; I used one large one as a gig-cover, which my son has also used, and I have given several of them away to my friends. I did not explain the manner in which I made the cement any further than it was formed of India-rubber; I did not tell how I formed it; whenever the question was asked me what varnish I used, I always said India-rubber, and so it always was for the best balloons I made. I do not varnish now with India-rubber, for the best of reasons—because it is of no use. I still use India-rubber for the purpose of uniting the seams together to the parts where the silk is double. I first read a description of making a varnish from India-rubber by Blanchard, which I found was not a good one, and could not be made to answer so; but I have made it myself perfect since. No balloon was ever made cemented together until I cemented one. I never found my experiments of dissolving India-rubber in spirit of turpentine to fail, as all these gentlemen did, except on the first trials; latterly I have found them uniformly succeed.

Cross-examined by Mr. Attorney-General.

The first of my ascents I made on the 19th of July, 1821, in a balloon manufactured of dissolved India-rubber, in the way I have stated; the first large one I ever made. Those I call miniature balloons varied in size from one foot in diameter to six or seven. I have no specimens made before 1823, except that pipe. India-rubber was well known from the time I was a child to be used for varnish; it was used by Blanchard and others, but they never could make a varnish of it to last. However, the India-rubber was handed down to me from Blanchard; I took the hint from him. I first made double balloons by means of India-rubber; the miniature ones twenty-five, or from that to thirty years ago. No one has ever assisted me since but my son. I have not mentioned to any one except my son the mode of doing it. I have explained that it was done with India-rubber, and in a manner superior to any other balloon made before. The India-rubber varnish renders a *single fold impervious* to air, but it is not *durable so, it is* not permanent. It is by *means of that I render* the single part of the balloon tight; but we are often obliged to replace it, if it is a varnish made of India-rubber. I have not got any of the other cement made of India-rubber and other materials; I have not had occasion to use it for some time. I have used for uniting two pieces together cement made of India-rubber and other materials, to unite the seams of the balloon, but not at the time to which I now allude. Gum-mastic and India-rubber, dissolved in the turpentine, is the cement—one for a smooth surface, and the other for a rough one, or a varnish. As far as the balloon itself is concerned, I have applied the compound cement to the balloon often, because I have frequently torn my balloon half a dozen times while it was being filled. I have applied the compound cement to unite the double folds where it is quadrupled. For the seams I employ the compound cement. I bought a cloak at Macintosh's, I think last September. Till within the last twelve months, I have never seen water-proof cloaks exposed for sale, except Mr. Macintosh's, manufactured in that way. Turpentine is rather a dear article of late; that is why coal-oil has become an article of commerce more than it otherwise would be.

Re-examined by Mr. Serjeant Talfourd.

I have not known any thing of coal-oil by that name, nor any other name, till these last twelve years. The varnish at this time is made with India-rubber; but there are other substances to prevent the action of the coal-gas. I could not get coal-oil without waiting a long time for it. I should have been satisfied with three or four pints a week. I have distilled the coal-oil found swimming on the surface of the water. It is a very simple process; all distillations are simple. The oil comes perfectly as soon as the separation takes place.

Mr. George Green, examined by Mr. Rotch.

I am son of the last witness. I was in the habit of assisting my father in the manufacture of balloons—both the miniature and the large balloons. I was acquainted with the solution that my father used at the time he made his coronation-balloon in 1820. I used to assist in cutting the India-rubber up into shreds. The solution was composed of India-rubber and oil of turpentine, and that was applied to the manufacture of the miniature balloons, which were of double texture; we covered it with a cement by means of a brush, and the two surfaces were put together, and formed a double substance, and then they were worked up into balloons. I attended my father at those places where he exhibited his balloons; some who came to look at the balloon have asked me the nature of the solution and of what the varnish was composed, and they have always received a correct answer—that the varnish is a solution of India-rubber in turpentine. I had a cloak made from the old balloon, and have worn it in travelling outside of coaches. Many have said, "What a nice, convenient thing this is, what is it made of?" In that case I have told them, "It is a piece of Mr. Green's balloon." I believe I said then it was made of a balloon cemented together by a solution of India-rubber. I have seen the tube produced used to convey the gas from the main to the balloon; it was made with the old materials, covered by means of the compound cement laid on with a brush and then placed together. The cement was India-rubber dissolved in oil of turpentine, with a portion of gum-mastic.

Cross-examined by Sir W. Follett.

Where an article has been previously varnished over, then we are obliged to use the compound cement; because the India-rubber cement having the mastic would not adhere to the oil surface, it is too smooth, and it has to be prepared. This pipe is made of what we call the compound cement. To any body that asked me how the varnish was made, I answered, that it was composed of a solution of India-rubber dissolved in oil of turpentine. I have heard my father asked how the solution was made, and he has always told them, though I never heard him enter particularly into the way.

Mr. Edward Spencer, examined by Mr. Gurney.

I know both Mr. Green and his son; have seen him cementing the parts of his balloons together. In 1822, on asking Mr. Green the nature of the cement, he told me that the preparation used was India-rubber dissolved in spirits of turpentine. I have seen him dissolve the India-rubber, and partly assisted him, as early as 1822. I had a part of the coronation-balloon given to me at the time; I have not used it as a cloak. It was impervious to water, here is the fragment of it [*producing it*]—I have had it by me from 1822 to the present time.

Cross-examined by Mr. Attorney-General.

I have never seen gum-mastic employed by Mr. Green; I think I have heard him speak of it as a composition used in forming some of the seams, or repairing a tear or a fracture. I have attended a little to chemistry, and I know what coal-oil is; I have distilled some. I have been at three extensive gas-works—Brick-lane, the Vauxhall, and the Dorset-street—and all that I have ever seen has been a film or filament, so difficult to obtain that *I could not get it till a fortnight after; I wanted it for a solvent for India-rubber.* I swear, that for years I have heard Mr. Green, the father, explain to a great number of persons how he made the solution of India-rubber with turpentine.

Mr. John Adams, examined by Mr. Rotch.

I am an old acquaintance of Mr. Green's, who gave me a cloak made of a fragment of the coronation-balloon; I wore it for about nine years, during which time it proved air and water tight.

Dr. Hancock, examined by Mr. Serjeant Talfourd.

I am a physician, and have been a good deal engaged in botanical researches. I have been a good deal abroad in British Guiana. I saw water-proof articles exhibited for sale in Demerara in the years 1812 and 1813—cloaks and hoods. I have seen gaiters at Rio Para, but not in Demerara. Examined those cloaks and other articles particularly, with a view to ascertain their texture and nature; they appeared to me to be constructed in the same manner as had been represented to me a year or two before at Rio Para, thus—the milk of the *hevea* was spread over one piece of cloth with a brush, or somehow or other, I do not exactly remember how—and another texture was laid upon it, whether of silk or cotton, and then it was finished; it was dried in a short time by being exposed to the sun. It was no secret in Demerara in what manner they were made; they were exposed openly for sale. These articles were not much commended in the colonies; there was a prejudice against them, for what reason I do not know—but I do not think they were very extensively sold in the colonies, and there is to this day a prejudice against them. I think the articles were not made in Demerara, because they had a prejudice against them even when they were brought there.

Mr. Serjeant Wilde read the passage from Humboldt's "Personal Narrative" (see *Mechanics' Magazine*, No. 659, p. 510).

Mr. Serjeant Wilde.—That is the defendants' case, my Lord.

The Attorney-General.—My learned friend, Mr. Serjeant Wilde, would represent men of science as ready to prostitute themselves for any purpose for which they may be wanted—

Mr. Serjeant Wilde.—That is your translation.

The Attorney-General.—Ready to do and say any thing that may gain the object for which they are subpœnaed as witnesses. It is marvellous if scientific men are so venal and unprincipled! And for this reason, because, with all the industry and wealth which has been contributed to upset this valuable patent, the parties have not been able to produce one scientific witness who could give any information on the subject in their behalf. Mr. Brande, Mr. Warburton, Mr. Daniel, Mr. Phillips, Mr. Cooper, Dr. Turner, Mr. Aitken, Dr. Fitton, and Mr. Children, are not venal men. Men of science, who have devoted themselves to those liberal and generous pursuits, are of a higher nature than has been described by my learned friend for the purposes of this cause. They may differ upon some debateable point as to whether the boiling sugar with steam or with oil may be more or less dangerous—that may be *vexata questio*, in which scientific men might fairly and honourably entertain different opinions: but all scientific men are unanimously agreed in favour of the plaintiffs. Mr. Spencer, who knows about as much of chemistry as my friend or myself, who try to get up enough for the purpose of a *Nisi Prius* cause, is the only scientific witness produced as a counterbalance to Mr. Brande, whose name has a European reputation, and the other eminent gentlemen I have mentioned. Mr. Macintosh, in June, 1823, took out this patent. From the moment the patent was taken out, manufacturing began; it was carried on extensively, although not so extensively and profitably as it has been within the last few years, from the very moment the patent passed the Great Seal—for several years at Glasgow large quantities, and afterwards at Manchester. He made large quantities for the Government of the country; an order he had from the Ordnance-office to the amount of 4 or 500*l*. in March, 1824. No one appeared as a rival for more than ten years after the patent was taken out; no one questioned his right to the patent; and no other cloaks possessing those qualities were exposed to sale. About a twelvemonth ago, Messrs. Ellis and Everington, in a manner not reflecting credit upon them, took up the manufacture of the article; under pretence that they have bought some man's patent, they label their cloaks, "Fanshawe's Improved Patent India-Rubber Waterproof Cloth." There is no such person as Fanshawe in existence, there is no such patent to be bought; this is pure invention. If there is such a patent, why is it not produced? Says my learned friend, "We do not like to tell you the secret by which we manufacture our's." Why, it is very odd that it should be a secret, if it be a patent. I thought my friend told us, in his very energetic and eloquent address, that the price which you give for a patent is, that you give in a specification a full and fair disclosure to the public of all. What do you think of a case which begins by stating what is utterly false? They are not contented even to come into fair and honourable competition with Mr. Macintosh; but they say they have got a patent, which patent does not exist; and if they begin by stating what is false, they will not be very scrupulous with regard to the means which they employ in getting evidence to support a plan that is thus based upon falsehood. They will not venture to produce one human being who could give you any account of the manner in which their article is manufactured, because they knew they could call no person who would not have said that process had been servilely copied and stolen from Mr. Macintosh's manufacture; and, peradventure, the person whom they called might have been some person decoyed from the employment of Mr. Macintosh himself; therefore they closed their case without venturing to produce such a witness. Although my friend was very eloquent upon the point, that we did not call all witnesses who were concerned in every branch of our manufacture, yet he has not produced any of his own manufacturers, because they only would have corroborated our case with regard to the piracy and the infringement. I know no species of property that, if it does exist, ought to be more respected than property in a patent. The first objection is, that the invention is not fit subject of a patent. Now, it will be enough for me to say that there is no such plea upon the record; there is no such objection in their enumeration of objections to which we are entitled under Lord Brougham's Act of Parliament. The process seems, indeed, very simple; and all things seem simple when they are discovered. The sublime theory of gravitation itself was discovered by Sir Isaac Newton from seeing an apple drop from a tree to the ground; and what can seem more simple than the discovery of Mr. Watt with regard to the steam-engine? It was perfectly well known before that steam might be condensed, and that if you condensed steam by the injection of cold water, a vacuum was produced. The only difficulty he had was advancing one step; and I may say that that step changed the history of the world. It was such a step that Mr. Macintosh took. The thing had never been known in this country before, and it is, therefore, the subject of a patent, and it is a most valuable discovery: he was, in point of fact, the person who did introduce this invention, which has now become an important article of British commerce. Supposing it to be the subject of a patent, my learned friend's second objection is, that this specification is not sufficient—first, that it claimed too much; and, secondly, that it does not fairly disclose that which Mr. Macintosh meant. The words of the objection are, "that coal-oil cannot be produced or made directly in making coal-gas, and the coal-oil is not the immediate produce of the coal-gas, and that coal-oil is too indefinite." The defendants wished to prove that there was only a thin film or filament that was ever to be found floating on the surface of the water in gas-tanks, &c.; I have proved that there was produced in a separate state of coal-oil as much as would swim a boat at any time—that in the metropolis you might have between 3 and 4,000 gallons a week. And all the witnesses proved that coal-oil was well and generally known by that name. If Lord Tenterden's directions are taken, and a fair and candid judgment exercised, it will be found that the specification is framed so that it effectually answers its purpose, and describes what is the invention, claims what is the invention, and abjures all that had been previously done. It does not claim all flexible cement, as has been argued, for it goes on to describe what is the nature of the manufacture that is claimed. You are to note, according to the case of King and Arkwright, the title and specification are to be taken together; and then you are not to take one sentence, one line, or one word of the specification, but to look at it as a whole, and to see what is the fair and just interpretation that ought to be put upon it. The words of the specification are, not *any* flexible cement, but by a "flexible cement in manner hereinbefore described"—he claims as his discovery the cement hereinbefore described, and the application of that cement. The second objection is, that we do not by this specification sufficiently describe how the oil is obtained, and how it is to be used. Let me, gentlemen, remind you, that is no part of the invention that is claimed; but it was necessary for us to describe a known solution, because it is the application of that known solution for which we claim our patent.—(The Attorney-General went through the specification, commenting upon it in answer to Serjeant Wilde's observations.)—This patent is not taken out exclusively to make water-proof articles for the purpose of wearing apparel; it may be applied to a tarpaulin, as a covering to a cart or a haystack—where it is wholly immaterial whether it smells like otto of roses, or whether it is as offensive as assafœtida. There is nothing in this specification to exclude the crude oil nor the rectified oil, you use either. The question is not as to the smell of the article, but whether it is impervious to air and water, and it is admitted that they are; they, therefore, answer the purpose proposed in the patent. As to the way of purifying the oil for making articles for fine purposes, all the witnesses agreed it was to be distilled. You merely put it into a retort, you raise the retort to the degree of heat that makes this come over, it rises before the impure articles, they remain behind, and it is afterwards collected in a pure and rectified state. Now *that is known to every tyro. The specification would have been ludicrous*, if it had described this process. You are not to state in the specification that which is known to all mankind; you are to communicate a secret, some new information, to tell the world that which they did not know—not to lengthen an instrument by stating that which may have been known for centuries. Our not calling workmen as witnesses to prove how the solution was made, was not because this was not the matter in controversy; it was how the solution was used, and that we have proved by calling witnesses who have been examined before you. But then, says my learned friend, you have departed from your own specification, and your patent, therefore, ought to be wholly upset. I say that the specification has been strictly, and literally, and rigorously pursued down to the present hour. Is it material whether the brush be moved by the hand, or by power obtained from a steam-engine? If that doctrine of my friend's were to prevail, there is not a valid patent two years old now upon the records of the Court of Chancery, for it invariably happens that (such is the spirit of improvement in this country) scarcely a specification is filed but there is some improvement. What is the patentee to do? Is he to renounce the subsequent improvements, or, if he avails himself of after discoveries, is he to be taunted with having departed from his own specification, and that he shall lose the property which ought to be so valuable to him? The only departure is an abridgment of labour, and a facility in the manner in which the machinery is now applied. The specification also does not say it must be done in the specific mode described, but uses the words "or other suitable means." What is the test of the specification? It is that the article may be made according to the specification, and five or six witnesses, who merely read the specification, deriving no information from any other quarter, receiving no instructions, nor directions, made the article; and it was produced before you, the two sides closely adhered, and every single specimen was proved to be impervious to water and to air. The next plea is, that the invention is not new; that it was publicly practised and used by divers persons, yet they do not produce all these persons, nor venture to give one tittle of evidence with respect to them. That it was publicly known and used, is what they undertake to prove. I will refer to a case that lays down the law upon this subject, I think very accurately and perspicuously—I mean the case of *Lewis* v. *Marling* (10th Barnewall and Cresswell). This case decided that the use must have been a public use, unless it could be shown affirmatively that the patentee had a knowledge of the subject in its imperfect state from the invention of another person. The patent was granted to the plaintiffs for improvements on shearing machines for shearing or cropping woollen and other cloths. Plea, not guilty. At the trial before Lord Tenterden, at the Westminster sittings after last Trinity Term, it appeared that the patent in question was granted in 1818, and the plaintiffs in their specification (which was accompanied by a drawing) claimed as their invention, thirdly, "the application of a proper substance fixed on or in the cylinder A, to brush the surface of the cloth to be shorn;" and, fourthly, "the desired method of shearing cloth across from list to list by a rotatory cutter." The brush for the surface of the cloth was soon found to be useless, and the plaintiffs never sold any machines with it. On this ground the defendant contended that they had claimed too much, and therefore the patent was void. As to the fourth thing claimed, the defendant contended that it was not new, and proved that a similar machine was in use at New York twenty years ago, and that a specification of it was sent over in 1811 to one Thompson residing at Leeds, who employed two engineers to manufacture a machine from it; but this was never finished in consequence of the disturbances made by the Luddites. This specification was shown to several persons, but the machine was never brought into use. It appeared also, that in 1816 a model for a machine to shear from list to list by means of a rotatory cutter was brought over from America by one Smith, and he showed it to three or four persons in his manufactory, but no machine was ever made from it, nor was it publicly known to exist; and Smith always used machines manufactured by the plaintiffs. It appeared also, that many years ago one Coxon had made a machine to shear from list to list, which was tried by a person called on behalf of the defendant, but he did not think it answered, and soon discontinued the use of it." There is ten times stronger evidence of prior use and knowledge than you have had adduced in the trial of this cause. "For the defendant it was contended that this evidence deprived the plaintiffs of the right to a patent, as their invention was not new." Now you shall hear what Lord Tenterden said. Lord Tenterden observed at the trial, "that as the invention of the machine for shearing from list to list by a rotatory cutter had not been generally used or known in this country, the plaintiffs might be considered the inventors within the meaning of the Statute 21 Jac. I. c. 3, s. 6, notwithstanding the specification and the model which had been brought over from America, and the making of a machine to work in that manner by Coxon; and his Lordship left to the Jury the questions whether it had been generally known, and whether the patent had been infringed by the defendants. The Jury found a verdict for the plaintiffs" in that case, as I hope they will in this. On an application made to the Court for a new trial, Mr. Justice Bayley observed, "If the model brought from America had been seen by the plaintiff, he could not afterwards have claimed to be the inventor; but if I discover a certain thing for myself, it is no objection to my claim to a patent that another also has made the discovery, provided I first introduced it into public use. Here is no ground to doubt that the plaintiffs were the inventors of the machine, and first introduced it into public use." I will call your attention to another case, Jones and Pearce, respecting the suspension-wheel. Jones had a patent granted to him for a wheel of a particular construction; it was proved, that before the patent was taken out, a wheel exactly upon the same principle had been made, that two carts upon that principle had been made and had been used by a gentleman near the town of Derby; and therefore it was strongly contended on the part of the defendant that the invention was not new, but Mr. Justice Patteson decided in favour of the patentee. Now upon these principles I hope this cause will be decided. I will now examine the proofs that have been brought forward, that the invention is not new. First, the sock, which is a piece of solid caoutchouc cut and placed between two layers of linen. This is not at all upon the principle of our invention; which is, that the India-rubber be applied in a state of solution. We next have Mr. Green, the aeronaut, who says, he addicted himself to ballooning from the time he was twelve years of age, and that he learned from Mr. Blanchard, his great predecessor, that India-rubber might be usefully employed in making a varnish. Then he thought that India-rubber (this was his own discovery) might be applied to unite the two folds of silk where it was desirable that the balloon should be double, and he did this. But I cannot help thinking that it was with the gum-mastic cement that the double pieces of the coronation balloon were united; he was not aware that the India-rubber alone was sufficient for the purpose, but employed a strong cement made of India-rubber and gum-mastic. But what does he say with regard to making it known? He says, "I never told it to any human being, and no person saw me conducting this process except my son;" and the son contradicts his father, for he says not only he told it himself, but he has heard his father tell it—as says also Mr. Spencer. Now, gentlemen, which are you to believe—Mr. Green, young Mr. Green, or Mr. Spencer? But Mr. Green's cement is not the same as our's, he employed oil of turpentine and gum-mastic along with India-rubber, and which clear it was a compound cement, and not the cement for the application of which our patent was taken out. The exhibition of the balloon, though it were to thousands, was not a publication of its construction; the spectators could not tell whether it was of one fold or two, or how the seams were united. The publication depends, therefore, upon what is said by his son, and what is said by the attorney, in contradiction to that which Green himself has solemnly sworn. The last witness on this point knew nothing about the matter; he went up, he had a shred of the wreck of the coronation-balloon, but he never heard how it was made. The passage in Baron Humboldt's book proves nothing, even supposing his fabrics had been united by the pure milk of the *hevea*. My friend may just as well say that barley is the same as beer or as alcohol, and milk as toasted cheese, as that the milk taken from the *hevea* is the same as the dissolved caoutchouc. The observations which I have made with regard to Humboldt apply to the Doctor from Demerara, and show that that process is entirely different. These were merely experiments, which had failed on account of this caseous substance, which was of so offensive a smell that they could not be used, and they had altogether been discontinued. I have now to draw your attention to Johnson's patent. The part of his specification in question is this.—"As to the waterproof compound I proceed as follows:—After the linen, woollen, cotton, or silk stuffs, or cloths, hats, or leather, are prepared by the above-described blanching lixivium, I stretch them into a frame, and having dissolved caoutchouc or India-rubber in spirits of turpentine (the smell of which is taken off by oil of wormwood) and spirits of wine, in equal quantities, the caoutchouc (having become a varnish) I spread with a large piece of the undissolved caoutchouc (instead of a sponge or brush) upon the wrong side of the prepared stuff, or cloth, or leather, and then sift over it." He does not put another piece, but "sift over it any coloured cloth, or silk, or worsted, or cony, or other wool, cut fine in the same manner as flock-paper is made, and being left to dry for a day or two by the flock, by its adhesion to the caoutchouc, is equal to any lining." This, gentlemen, is a patent, I believe, like the great majority, that fall still-born, are never brought into operation—there is no proof that one single specimen ever was made from 1797 down to 1836; and whether it was for a flock-paper or cloth for garments, there is no pretence for saying that it is at all of the same nature as the process described by Mr. Macintosh. Mr. Hancock's patent, dated in 1825, is brought forward, *but no subsequent* discovery, no subsequent use, no subsequent process, no subsequent application of any thing that may have since been discovered, can in the slightest degree affect the validity of Mr. Macintosh's patent; and although it is there mentioned that the coal-oil should be rectified, it is not necessary that it should be highly rectified for many purposes, and so to have introduced these words would have rendered the patent void. My friend has tried to throw some ridicule on the Chemical Club. Gentlemen, I should have thought the memory of Dr. Wollaston might have been treated with more respect; he was a distinguished member of that club, which was a focus of information, to which every discovery made in the most distant parts of the empire was soon conveyed, its merits tested, and a judgment pronounced. All the members who have been examined say, if there had been such a process known they must have been acquainted with it, and they hailed it as a discovery of the greatest importance. If you decide that the patent is good, the infringement has been proved,—one of the defendant's cloaks, put forth as Fanshaw's patent, has been bought by a witness, and pieces of it analysed by chemists, (Messrs. Phillips and Garden), who say that they have no doubt but that it is the same as Macintosh's.

The *Lord Chief Justice* then proceeded to sum up, but was in a short time stopped by the Jury, who returned a verdict for the plaintiffs.

BRITISH MUSEUM.

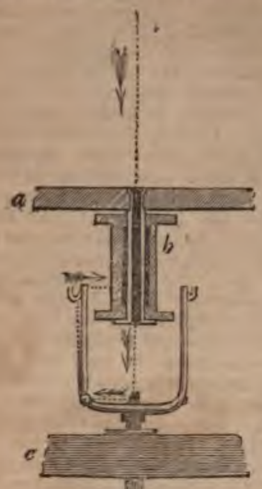
Sir,—I beg to call the attention of your readers to a petition about to be presented to Parliament, praying for a reform in the management of the British Museum; the opening of the establishment in the Easter, Whitsun, and Christmas weeks, and during certain hours on Sundays; and for the erecting of a detached fire-proof reading-room for evening visitors. Of the necessity for these alterations and improvements there can be no question; and if the petition were signed, as I think it will be, by a very considerable number of persons, its highly valuable objects would be obtained.

I am, Sir,

Yours, &c.

E. S. A.

IMPROVED THROSTLE FRAME-SPINDLE.



Sir,—The above figure shows a throstle frame-spindle of a different construction from those in ordinary use. The principal advantages which this form of spindle has over the other forms are, first, less tendency to vibrate, on account of the collar which supports its top end being placed quite close to the flyer; it is also much lighter, and for this reason it may be driven at a very great speed; and as the spindle has no vibratory motion, the strain on the thread, occasioned by the friction of the bobbin, is very uniform. The only disadvantage in this plan is, that when the thread breaks, it is rather difficult to piece, as the thread has to be pulled through the hole in the tube or stud which supports the bobbin, by means of a wire hook; but this, I think, is more than compensated for by the draw of the bobbin being so very uniform, that the thread seldom breaks, unless a part of it happens to be bad, and in this case it should be broken.

I have had a spindle on this principle working for a considerable time now, making thread, and it answers its purpose well. The quantity of draw of the bobbin may be altered at any time, by placing a cloth washer, of the proper size, on the top of the flanch of the tube which supports the bobbin. If more draw is wanted for any purpose, than can be easily obtained in this way, a groove may be turned in the top flanch of the bobbin, so as to receive a string, which is pressed against the bobbin by means of a small weight.

I cannot show the method of slipping —that is, the way in which the bobbins are taken off and put on to the machine, without another sketch. I have a very speedy method of doing this, and will give it, as also the way of carrying the twist up to the rollers, if the machine is used for spinning, should the invention be fully proved, if it is found to be a good one. A large throstle-frame on this principle will be ready and working in about six or nine months.

In the engraving, *a* is a part of the rail which supports the bobbins, and *b* is one of the bobbins. The bobbin works loose on a stud, which is fixed to the rail *a*: the stud, together with the rail *a*, and the bobbin, are shown in section; *c* is the rail which holds the top collars of the spindles; and *d* is the rail into which the foot steps of the spindles are fixed. The two last-named rails are firmly fixed to the framing of the machine, and the rail *a* is moved up and down by means of a heart motion, to build the thread on the bobbin. The dotted line shows the thread, and the arrows point out the way in which the thread passes to the bobbin. It will now be seen that the stud on which the bobbin works must be a tube, so as to allow the thread to pass through it.

If the flanch on the tube which supports the bobbin was made very large in diameter, the thread would pass on to the bobbin, without the two under hooks on the flyer. I tried this plan, and it did very well; except when the bobbin was near the lowest point of its up and down motion. When in this position, the part of the thread at the flanch got so far behind the flyer, that the part of the thread betwixt the top of the flyer and the flanch came in contact with the flanch of the bobbin; but I do not think that this would have taken place, if the flanch on the end of the tube had been made a little larger in diameter.

Yours, &c.
JAMES WHITELAW.
Glasgow, March 16, 1836.

ELECTRO-VEGETATION.

Letter III.

Sir,—In consequence of what has been advanced in my two preceding letters, pp. 99, and 402, concerning the connexion between the electricity of the atmosphere and vegetation, I request the patience of the reader while I take a review of facts, most of which are well known, relative to the peculiar fitness of plants from their structure and properties, and from the nature of the elements by which they are surrounded, for receiving electric influence; more especially, as it was by such general considerations that I was induced to make the experiments which evinced the great superiority of their conducting efficacy to those of all other substances, and which have received such ample additional support from those of Mr. Weekes. The several branches of the subject may be stated as follows: 1st. Amid the immense diversities of the vegetable kingdom, there are several important particulars in which they bear a common relation to electricity. The solid fabric of a plant, in a state of complete separation from its fluid contents, is a perfect non-conductor, impermeable to electricity; it is every where, in the line of its trunk, branches, and roots, bored with capillary tubes of such extreme minuteness, as to be discernible only by the higher magnifying powers of the microscope. In proportion to its dimensions, its branches and roots are divided into innumerable slender and tapering ramifications, spreading on every side in the atmosphere and the soil to a wide extent beyond its central stem or trunk; and while the general form of the branches and roots is rounded with a smooth and even polished surface, the former are furnished with buds or leaves which have uniformly acute extremities. Now this is a fabric admirably adapted for the reception of conducting liquids destined to be acted upon by the electricity of the surrounding elements. The dry fabric, itself unsusceptible of electric influence, confines the action of the subtle fluid to its liquid contents; its capillary tubes are exactly fitted to facilitate the rise and diffusion of liquids possessing conducting virtues, by the action of electricity: the passage of such liquids through capillary tubes having been proved by the numerous and decisive experiments of the Abbé Nollet[*] to be greatly increased by electricity in degrees advancing with their minuteness.

2nd. That the sap of plants is a powerful conductor, appears from the fact of the superior conducting virtue of the points through which it is influenced; for when these points in common with the rest of the solid fabric are deprived of their liquids, they are destitute of all conducting virtue. This also appears in some degree from the composition of the sap, as it consists chiefly of water and carbonic acid; but its conducting virtue must be much aided in its operation by the minute tubes through which it receives the electric influence. By its action on the sap under such circumstances, in conjunction with those mechanical causes which have been assigned by physiologists, we shall probably be enabled to find the easiest solution of the fact, that the sap advancing through successive stages is mounted to the utmost summit and extent of the loftiest trees. At last, a continued positive electricity, acting probably in those strata which surround the highest trees with the greatest energy, from its distance from the humbler vegetables, and from the uninterrupted motion of the winds at these altitudes, must act in addition to capillary attraction, and the contractile motion which has been ascribed to the tubes in forwarding the general result. I have observed it greatly promoting the rise of a liquid in strips of porous paper; and strongly incline to the opinion that, as the subtle fluid extracted from oxygen gas in the lungs is the primary cause of the circulation of the blood in animals, to which the structure and mechanical motions of the heart and blood-vessels are only accessaries, so the same subtle fluid in the atmosphere is the primary cause of the rise and diffusion of the sap in plants, to which the structure of their tubes, and the contractile influence to which they are said to be subjected, are likewise only accessaries. The sap, like the blood of animals, contains the materials for the nutrition of the fabric; and the electric fluid introduced from its upper extremities must not only act through the sap-vessels in drawing it upwards, thus promoting the absorption of the moisture from the soil in a state of comparative negation by the fine extremities of the roots; but, being the general cause of chemical action, it must give rise to those separations and combinations of oxygen, carbon, and hydrogen, by which, in concurrence with the secretory vessels, the various juices and solids of the plant are produced, and gradually enlarged and matured.

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[*] See Priestley's History of Electricity, pp. 135—145.

3d. The atmosphere in a state of dryness, or separation from its clouds and vapours, being a non-conductor and electric, is admirably adapted for retaining a portion of the electric fluid, and gradually imparting it to the points of vegetation. Were this element a free conductor, it would at once transmit the electric matter to the earth in a manner so uniform and universal, that an equilibrium would be constantly maintained; but being invested with the opposite property, large portions of it are lodged in it in a state of readiness to be imbibed by those myriads of conducting pipes which issue up almost every where from the earth, and from their peculiar structure convert it to the most useful purposes. So great, indeed, is the quantity of electric matter which is furnished from this mighty electric, that not all these myriads of potent conductors can so far exhaust it, as that some sensible degrees of positive electricity are not always discoverable in it, during the day season at least, which is the period of active vegetation. As the electric property of the air in union with its gaseous state brings it in *constant contract* with the extremities of plants, so its *winds* must be of great use in imparting its electricity to the stiff points of the buds and germs. Triturating on these living embyos of vegetation in successive volumes, it must convey to them continually fresh portions of the fluid; thus producing that first excitement of the vegetating principle by which its dormant energies are awakened in the spring season. This influence applies in the greatest degree to the loftier vegetation, where it is most required; but every vegetative shoot, whether from the surface of the soil, or from herbs and plants of every altitude, is finely fitted to imbibe electricity from the strata of air with which it is contiguous; probably the reflection of the sun's rays from a dry surface of earth on a bright day, affords copious supplies of electric matter to the grasses and herbs as they emerge from it.

4th. Clouds and vapours form another source from whence plants are supplied with electric matter; and their acute extremities are active organs in obtaining this supply. Cold has been generally assigned as the cause of the condensation of vapour; and the peculiar coldness of buds and leaves has been alleged as the reason why it is attached to them in the form of water, in greater abundance than to other substances. But, upon this principle alone, how can we account for the pearly drops which attach so exclusively to the pointed extremities of the grasses, and which appear like rolling orbs upon the cabbage, strawberry, and many other herbs? Grasses in proportion to their length and acuteness are the most potent even of vegetable conductors; and these are the most distinguished for the avidity with which they attract the dew-drops at the approach of evening, and for being the last to part with them as the morning sun advances. If the fibrils of the strawberry-leaf, of the alpine wall-cress, &c. be examined with the microscope on a dewy morning, beautiful globules will be seen attaching exclusively to the extremities of the points; in the former, these points are of considerable length, and placed at convenient distances from each other, for the purpose of electric action on the surface of the leaf; in the latter, the arrangement of the points is so curious, that the design can hardly be questioned: numerous upright stems arise every where from the surface of the leaf, branching into four smaller fibrils, terminating in acute points, to each of which a small globule of water attaches, while a larger one decorates the common centre at the apex of the stem! Every advantage is thus given for electric action; the process of condensation by cold is aided by electricity; the liquid nutriment is copiously conveyed to the leaf, together with a large portion of its "electricity of vapour." As dews thus afford nourishment in union probably with a vital principle which operates to cause the several processes of vegetation in the humbler herbs and grasses; so when the moisture arising from the soil advances higher, and remains longer in the atmosphère in the form of fogs, it is attracted by the larger shrubs, and appears to be of peculiar use in the late autumn, winter, and early spring seasons, by cherishing our evergreens, hawthorn hedges, &c., to which it manifestly attaches copiously. Evergreens, indeed, have smooth surfaces; but is it not reasonable to think, that in addition to the action of their edged extremities, when the more active leaves of deciduous plants are removed, their *pores* have a considerable conducting energy in imbibing the electric matter together with the moisture? Again, nothing is more evident than that the *thorns* of the hawthorn, gooseberry, &c., are active agents in attracting these vapours, and condensing them on their extremities.

The clouds of the higher strata of the atmosphere appear to be formed, not by moisture from the soil, as in the case of dews and fogs, but from the evaporation produced by the action of the solar beams upon the leaves, and upon the waters of the ocean. That, in addition to the condensation caused by cold currents of air, they are acted upon in a similar manner by the electric attraction of the loftier vegetation, there appears every reason to conclude both from analogy and from facts. So powerful is their attraction in some of the more detached islands of the western ocean, that they are a principal means of furnishing their inhabitants with water. In those situations in which a few trees form almost the only medium of electric communication between the clouds and the earth, the fluid concentrating its action upon them, they are described as "perfect alembics;" one species in the Isle of Ferro "distilling water" so copiously from its leaves, as to have received the name of "the fountain-tree," and as such supplying the natives with this essential of life. The property which trees show in those peculiar circumstances in so extraordinary a degree, is, no doubt, exerted in all cases in which clouds are accumulated around them. When they are forming, and gathering to rain, a contrary process appears to take place in the soil from that of yielding moisture, as it imbibes it. May not this arise from the positive electricity causing a reverse process in the leaves and upper ramifications of trees, to that which obtains under a bright sunshine? The electric matter is propelled through their pores, and from the adjacent soil, causing a negative electricity in both; when a large portion of electric matter is absorbed, carrying with it copious supplies of moisture, both to the trees and to the earth. It accordingly accumulates in increasing drops as it approaches what, under those circumstances, has been aptly termed the *thirsty* earth. For, though not always actually *dry*, it appears, from the few observations I have made, to be always *attractive* in showery weather, or when the clouds are forming for rain. This, as has been hinted, is the reverse of what occurs in the formation of dews and fogs, and appears to commence on the removal of these lesser vapours; which, having discharged their office, and subsided, a grander effort is made for imparting a new supply of water and electric matter at once to the leaves and roots of vegetables in general, and of the loftiest trees in particular. The principle of evaporation is universally changed for that of absorption; so powerful an electricity has accumulated from the clouds, that the fluid, together with the small portion of moisture with which it is combined, is propelled downward, till additional supplies of them have been introduced into both the plants and the soil, when the atmosphere clears, and the ordinary process of evaporation is resumed with the increasing number and strength of the solar rays.

The distinction which I have made between the causes of dew and fog, and those of clouds and rain, has arisen, chiefly from observations on glass vessels inverted on the soil. When the atmosphere has been at and below the dewy point during the two last months, moisture has arisen from the soil, forming dews, hoar frost, and fog or haze: whether the latter has been attended with any deposition of moisture from the atmosphere, I have not been able to determine. The former settle chiefly upon the grasses and herbs, and the latter upon the evergreens and shrubs. During the rainy days and nights no moisture arose from the soil, the inverted glass remaining dry. On March 5th, I observed that a dampness had arisen, and continued in the glass from 7 a. m. till 2 p. m.; but from 3 to 6 p. m. the dampness disappeared from the glass, and on breathing into it this moisture again was absorbed. From some former observations, I inferred that this change in the soil might prove the precursor of rain, although there was at the time little alteration in the clouds, which appeared rather light and lofty; but at about half-past 6 a sudden and heavy shower fell which continued till near 8. At 10 p. m. the atmosphere had become transparent, and some dampness began to appear in the glass; but some rain commencing the next morning the dampness did not accumulate.* I suspect a similar effect is produced on the extremities of plants when clouds gather to rain (evaporation from the leaves requiring the action of strong light); and consequently that a general tendency to absorption, both in the plants and soil, are the attendants of its approaches. From some accurate experiments related by Mr. Williams in his "Climate of Great Britain," pp. 66, 67, it appears that a strong positive electricity in a heavy cloud first produces a negative state on the atmosphere and earth beneath, which on falling in rain leaves the former in a state strongly positive with respect to the earth. From these causes absorption will be produced in both the soil and in its vegetable productions during rain, and on its approaches; while, in proportion as the atmosphere at the spot where the clouds are condensed to rain is elevated above the earth and contiguous to the trees, it will cause a positive electric state in them with regard to it after the discharge, making the sap to mount upward, and the general process of evaporation from the leaves to proceed. This process ceasing during the absence of the sun, the soil for a time on still mornings appears to become positive in regard to the atmosphere; and its moisture combining with the electric matter in the gaseous form rises, and is quickly condensed by the cold which this process produces, in conjunction with the attraction of the herbs and grasses thus increased in vigour.

"In countries which are uncultivated the weather is mostly in the extremes. Rain when it comes takes the form of an overwhelming flood, not gently entering into and moistening the soil, but rushing along the surface, tearing up one place, strewing another with *debris*, and reducing both to a state of indiscriminate ruin; while scarcely has the flood gone by, when the returning heat evaporates the little moisture which is left behind, and burns up the coarse and scanty vegetation which the rains had fostered."† That all these evils must be much mitigated, and even converted into their opposites by the presence of a sufficient number and variety of plants in a state of improvement by cultivation, will, I trust, be in some measure evident to the intelligent reader from the remarks which have been already offered; but it is hoped will still further appear on directing our attention to the electrical relations of *light* and of the *soil* upon vegetation, which must be reserved for a future occasion.

I remain, Sir, yours respectfully,
T. Pine.

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IMPROVED METHOD OF TAKING LEVELS.

Sir,—In the first number of the *Magazine of Popular Science*, it is stated that a Telford medal was awarded last year to *Mr. Gravatt*, C. E., for a pair of levelling staves, that enabled the surveyor to read off the observation at once, instead of its being reported to him by the assistant, the levelling staff being graduated from the bottom as usual, and painted in black and white.

Now, sir, I beg to state that I have been in the habit of reading off my observations in a similar manner for about ten or twelve years past, with white painted staves, the divisions and figures being in black, and varnished, and the ends capped with metal.

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* *These changes in the soil with the approaches of rain and of fine weather, have been repeatedly confirmed by subsequent observations.*

† Library of Entertaining Knowledge, vol. xx. Part 1. pp. 2, 3.

I generally use two pair of staves; one pair six feet, and the other twelve feet in length. Thus, when the altitude is above six feet, I avoid the inconvenience and delay attendant on the sliding up of the common staves. The telescope of my level is thirty inches focal distance, with an aperture of nearly two inches; so that I can read off with much greater expedition, and more correctly than with the common level and staves.

In taking a series of levels, made by order of the Ouse Bank Commissioners, over a tract of upwards of thirty thousand acres, during the year 1834, I used the above-mentioned staves of my own construction; the levels were taken in stations of one furlong in length, i. e. the staves were placed 110 yards from the instrument each way; and when the weather is favourable, I can read off correctly to the hundredth part of the foot, and have frequently taken circuits of from three to twelve, and even eighteen miles, with a difference of from one-fifth to half an inch only!

In the same paper we are informed, that Mr. Scott's practice is to have one side of his levelling staff painted in black and white, and the other side red and white, the red side being graduated 225 feet higher than the black or true one. I had my staves divided into yards, tenths, and hundredths, the yards being numbered with numerical letters, and the tenths in Saxon figures; the smaller divisions I subdivided into four parts. A yard is thus subdivided into 400 parts.

When the difference of the level of two or more objects at a considerable distance from each other is required, the difference between the back and fore sights is the difference required: thus the process of reducing the observations at each station is dispensed with. Now, if the levels are to be taken in yards as well as feet, it is only necessary to multiply the difference between the back and fore sights in yards by three, which gives the difference of the sights as taken in feet, if the levels are correctly taken. I have not, however, practised this method for five or six years past, as when I have made an observation I enter it into my field-book, and take a second *sight before the staves* are removed; and *by this precaution* it very rarely occurs that a mistake is made. I should, however, recommend the above, or Mr. Scott's method, to the *young engineer*, as the safest, and likewise the most correct.

Within the last twelve years, I have taken the levels over about forty thousand acres of land for the Commissioners of the Court of Sewers. The stations were taken in furlongs. I had a set of iron figures made, and stakes driven into the ground at each station, level with the earth's surface; each stake was numbered by being branded with the above figures, made red hot, and each line of levels was also numbered, and a fresh series of numbers for each line of levels (which I found necessary, in order to avoid high numbers): whence, after taking the levels on the outside of this tract of land, the interior lines of levels were proofs to the levels taken before, the lines of levels being all connected. The plan I adopted is as follows:—Supposing I am going to take a line of levels, say No. 15 :—

No. 15. From station 23, line 1, to station 17, line 9.

My observations taken in the field are copied into a book, for the purpose of reducing them to a certain level: whence, by taking the rise or fall in line 15, and comparing it with the difference of the level of station 23, line 1, and station 17, line 9, I have a direct proof as to the correctness of the levels in lines 1 and 9, as also that of No. 15, just taken.

I am, dear Sir, yours truly,

JAMES UTTING, Civil Engineer.

Lynn Regis, March 12, 1836.

ON TUNING.

Sir,—Several of the first mathematicians, as well as musicians, have spent much time in endeavouring to discover the best manner of tuning instruments with fixed tones (piano-fortes, organs, &c.), though their endeavours have not, as yet, been attended with the desired success; but, without branching into the depths of mathematical science, we will see how far the practice and theory of tuning agree together.

The system most in use, at present, for piano-fortes, is that known by the name of equal temperament; which consists in dividing the imperfection of the scale or wolf, as it is generally termed, equally amongst the 12 major keys. This is open to many objections; for, according to this system, there is not a single perfect third, fourth, or fifth in the whole instrument. Every third is sharp, and equally sharp; every fourth sharp, and equally sharp; and every fifth flat, and equally flat: therefore, not only is every major key rendered imperfect, but equally and similarly imperfect. This necessarily destroys that difference of character that should exist in a well-tuned instrument between the different major keys. And the minor keys are liable to the same defect, for the same reason. Thus is dull monotony substituted for pleasing and orderly variety; and modulation from key to key loses, in a great measure, the very object of modulation, which is to relieve the ear, and cause us to return to the original key with increased pleasure; arising from the systematic variety of the different keys through which we have successively passed. All those chords which nature has rendered perfect are made imperfect; and, in those instruments where chords are made to sound for a considerable time, as in organs, the imperfection of the equal temperament is most striking.

In opposition to this, we have unequal temperament; but, as the equal temperament is fixed and unalterable, this comprises every possible variety of tuning. The tuners of the old school used the unequal temperament in their bearings, which were tuned by fifths and octaves; and "The Wolf" was generally thrown into the key of E or A *flat*. The more modern tuners comprise their scale within the septave, and tune by fourths and fifths; though we should more properly say, by thirds and sixths, as it is by those intervals that the scale is tried and regulated.

Many have considered that the fifth and octave are the only two perfect intervals, but the third and sixth should rather be considered so, for we may sharpen or flatten both fifth and octave very considerably, without affecting the ear; but try them with the corresponding third or sixth, and the beating is very perceptible.

The mode of tuning by occasional fourths is one that will not suit the learner; inasmuch as they do not strike *the unpractised* ear so well as fifths; *but experience* has proved it to be the *best for practical* purposes, especially if the scale be divided thus: —C—G, G—D, D—A, A—E, E—B, B—F *sharp*; again, C—F, F—A *sharp*, A *sharp*—D *sharp*, D *sharp*—G *sharp*, G *sharp*—C *sharp*, which completes the septave. It may be necessary to observe that the starting point is the middle C of the piano.

Earl Stanhope has constructed a very beautiful and scientific system of tuning, *in theory*, but extremely difficult in practice, and one that is very unsatisfactory to many ears; and after all it is, perhaps, the better way to accommodate the temperament to the taste of those who prefer a particular key, which a good tuner always can do.

These few remarks are intended more for the practical tuner, than for the amateur or professional; who, though they can point out the defect in that key which does not please them, yet cannot rectify it themselves.

CORIO.

March 21, 1836.

MACHINE-MADE BRICKS.

Sir,—It has been noticed on the Leeds and Selby Railway, that the moisture had filtered through some of the bricks of the archway in the tunnel at Leeds, where they come in contact with damp or wet soils; and also on the Liverpool and Manchester, at the Manchester end the open brick archways are injured by wet weather and frosts destroying the bricks. It is, therefore, an object of great moment to those who have the superintendence of works of this nature, to obtain a sound, imperishable brick, at about the same price as is now paid for the meanest article, and which could be manufactured in places contiguous to where the works are carried on.

After many abortive attempts at brick-making by machinery, an engineer of some talent has, at last, produced machines which have proved successful. The principal difficulty, that of the stickage, or adhesion of the clay, when pressed into moulds with great mechanical force, has been overcome (see *Mechanics' Magazine*, No. 618). Several Continental states, including Prussia, have given orders for these machines, after the personal inspection of their accredited engineers.

The machines may be worked by steam-engines of one or two horse power, or by wind or water; the clay is prepared by knife-grinding, in the pug-mill affixed to the machine, over which there are rollers attached for the purpose of crushing stones, hard or what is called dicey clay, as well as any small particles of lime that may happen to be intermixed—which, together with the process of pressure in moulding the clay, is completed under one operation. The hand-labour machine requires one man only to work it and mould the clay. The application of the article for the removal of the stickage is so affected, that a perfectly sound brick, excellent in appearance, is produced. Very great compression is given it at its first moulding (which has always been before unattainable), so that it is far superior to bricks subjected to a second moulding, which, from being in a half-dried state, are crushed and made unsound, from the interruption given to the gradual progress of drying. The bricks of the open archways of the London end of the Greenwich Railway, or even those used for the outer and centres, are extremely porous, and of a mean description indeed; and it is not reasonable to suppose that the Directors of this, and other similar works now in progress, would use such an inferior article, when impenetrable bricks can be procured at the same, or even a lower price. It is certainly acknowledged, that such fabrics should be of lasting permanence, and not insecure and unstable.

J. J. C.

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 22ND OF FEBRUARY AND 22ND OF MARCH, 1836.

Clinton Gray Gilroy, of Argyle street, New-road, St. Pancras, engineer, for certain improvements in machinery for weaving plain and figured fabrics. Sealed Feb. 25; six months to specify.

William Gilyard Scarth and Robert Scarth, both of Leeds, dyers, for the manufacturing or preparing of a certain substance for blue dyers, from materials not hitherto used for that purpose, applicable for dyeing blue and other colours. Feb. 26; six months.

James Barron, brass-founder, and Edward Thomas, workman to James Barron, both of Birmingham, for improvements on bedsteads, and apparatus to be used with or for bedsteads. Feb. 26; six months.

Robert William Sievier, of Henrietta-street, Cavendish-square, gentleman, for an improvement in the means of dissolving and preparing caoutchouc or India-rubber for various purposes. Feb. 27: six months.

James Martin, of Charing-cross, gentleman, for an improvement in dissolving and preparing caoutchouc or India-rubber, to render it applicable to various *useful purposes*; being a communication *from a foreigner* residing abroad. Feb. 27; six *months.*

William Bates, of Leicester, fuller and dresser, for improvements in the process of finishing hosiery and other goods manufactured from lamb's-wool, angola, and worsted yarn. March 8; six months.

Charles Schafhautl, of Sheffield, gentleman, for improved gear for obtaining a continuous rotary action. March 8; six months.

Anthony Theophilus Merry, of Birmingham, metal-dealer, for the application of certain white metal plated to certain manufactures of which it has not hitherto been applied. March 8; six months.

James Morison, of Paisley, manufacturer for improvements on the Jacquard-machine, and on what is called the ten-box lay, and in the reading and stamping-machines used in making shawls and figured work. March 8; six months.

John Galley Hartley, of Devonshire-street, manufacturer of caoutchouc, for improvements in preparing or manufacturing caoutchouc or India-rubber for various useful purposes. March 8; six months.

John Godwin, of Cumberland-street, piano-forte maker, for an improvement in the making or construction of piano-fortes. March 8; six months.

Benjamin Simmons, of Winchester-street, Southwark, engineer, for certain improvements in retorts, stills, and other chemical apparatus, and the machinery connected therewith, and by the use or employment of which, various processes can be more speedily, conveniently, and economically performed. March 8; six months.

George Holworthy Palmer, of the Canal-grove, Old Kent-road, civil-engineer, for an improvement in the purification of inflammable gases, and an apparatus by which the improvement is applied; such apparatus being also applicable to other useful purposes. March 8; six months.

Charles Guynemer, of Manchester-street, Manchester-square, professor of singing, for certain improvements in piano-fortes; being a communication from a foreigner residing abroad. March 8; six months.

George Lawrence, of No. 9, New Bond-street, dressing-case maker, for a certain improvement in the screws used for fastening the mouths of mounted inkstands, perfume liquor and medicine bottles; also in fastening the mouths of jars and tumblers used for paste, salve, powders, preserves, and other purposes. March 8; two months.

James Diggle, of Bury, engineer, for certain improvements in steam-engines. March 8; six months.

Charles Watt, of Clapham, gentleman, for certain improvements in preparing, purifying, and refining tallow-stuff, fatty materials, and animal and vegetable oils for various useful purposes. March 8; six months.

John Masters, of Leicester, for an improved essence of anchovies. March 14; six months.

John Chalklen and Thomas Bonham, of Oxford-street, water-closet manufacturers, for an improvement or improvements on the instrument or apparatus commonly known by the name vices. March 14; six months.

Edward Jelowicki, of No. 8, Seymour-place, Esq., for certain improvements in steam-engines. March 14; six months.

Thomas Alcock, of Claines, Worcester, lace-manufacturer, for certain improvements in machinery for making bobbin-net lace for the purpose of producing certain kinds of ornamental bobbin-net lace and other fabrics, by aid of the improvements, which are in part applicable to machinery constructed according to his former improvements, for which two several Letters Patent were granted to him on the 8th day of December, 1832, and other Letters Patent on the 12th day of February, 1835. March 17; six months.

Alphonsus William Webster, of Regent-street, aurist, for an instrument or apparatus to be applied to the ear to assist in hearing. March 17; six months.

John Birkby, late of High Town, but now of Upper Rawfolds, both in Liversedge, card-maker, for improvements in machinery for making needles. March 17; six months.

Louis Elizee Seignette, of Mincing-lane, merchant, for improvements in preserving animal and vegetable substances; being a communication from a foreigner residing abroad. March 21; six months.

Walter Hancock, of Stratford, engineer, for an improved arrangement and combination of certain mechanical means of propelling vessels through water. March 21; six months.

Robert Brettel Bate, of No. 21, Poultry, optician, for his invention of certain improvements upon hydrometers and saccharometers, for the term of seven years, to be computed from the 21st day of March instant; being an extension of former Letters Patent for the said invention granted to the said R. B. Bate by his late Majesty, King George IV. March 21.

Francis Gybbon Spilsbury, of Newman-street, engineer, for certain improvements on machinery or apparatus for stamping up and compressing metals or other substances. March 22; six months.

William Maugham, of Newport-street, Lambeth, chemist, for certain improvements in the production of chloride of lime and certain other chemical substances. March 22; six months.

William Hale, of Greenwich, late of Colchester, civil-engineer, for certain improvements on machinery applicable to vessels propelled by steam or other power, which improvements or parts thereof are applicable to other useful purposes. March 22; six months.

William Westley Richards, of Birmingham, gun-maker, for certain improvements in primers for discharging fire-arms by means of percussion. March 22; six months.

John Cox, of Bristol, of the firm of Harding, Cox, and Shaw, soap-manufacturer, for certain improvements in the manufacture of soap, which will be particularly applicable to the fetting or fulling of woollen cloths. March 22; six months.

Sir John Scott Lillie, Knight and Companion of the most Honourable Military Order of the Bath, of Fulham, for an improved mode of acquiring power for the purpose of propelling carriages, barges, and other the like contrivances for conveying goods and passengers. March 23; six months.

John Lionel Hood, of Newcastle-upon-Tyne, gentleman, and Andrew Smith, of Princes-street, Leicester-square, engineer, for an improved mode of manufacturing belts, bands, and straps, to be employed in place of ropes or chains, and for other useful purposes. March 26; six months.

William Blurton, of Field Hall, Stafford, gentleman, for an improved method of, and apparatus for, extracting milk from cows and other animals. March 26; six months.

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LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 21ST FEBRUARY, AND 22ND MARCH, 1836, INCLUSIVE.

Robert Griffith, of Birmingham, machine-maker, for improvements in machinery for making rivets, screw-blanks, and bolts. Sealed Feb. 27, 1836.

William Wainwright Potts, of Burslem, Stafford, *china and earthenware* manufacturer, for an improved method or process of producing patterns in one or more colours, to be transferred to earthenware, porcelain, china, glass, and other similar substances. March 1, 1836.

John Baillie, of Great Suffolk-street, Southwark, engineer, for improvements in propelling of vessels and other floating bodies by means of steam or other power. March 1, 1836.

Miles Berry, of Chancery-lane, civil engineer, in consequence of a communication made to him by a certain foreigner residing abroad, for a certain improvement or certain improvements in power-looms for weaving. March 4, 1836.

William Wilson, of Glasgow, manufacturer, for a method of making chains of wire. March 7, 1836.

Charles Schafhautl, of Sheffield, gentleman, for improved gear for obtaining a continuous rotary action. March 8, 1836.

Charles Schafhautl, of Sheffield, gentleman, for an improved steam generator. March 8, 1836.

John Barsham, of Stepney Causeway, Middlesex, oxalic acid manufacturer, for improvements in the manufacture of oxalic and salacetocella. March 8, 1836.

Clinton Gray Gilroy, of Argyle-street, New-road St. Pancras, engineer, for certain improvements in machinery for weaving plain and figured fabrics. March 15, 1836.

Francis Brewin, of the Kent-road, Esq., for a certain new and improved process of tanning. March 18, 1836.

James Morison, of Paisley, manufacturer, for improvements on the Jacquard-machine, and on what is called the ten-box lay, and on the reading and stamping machines used in making shawls and other figured work. March 18, 1836.

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NOTES AND NOTICES.

Errata.—In Mr. Whitelaw's paper on Perspective Drawing, *Mechanics' Magazine*, No. 642, line 31 from the beginning of the 3d paragraph, for "*r d* will show" read "*i d* will show."—Line 16 from the beginning of paragraph 6, for "the end of a hollow cylinder, standing in a perpendicular direction," read "the top end, of a hollow cylinder standing in a perpendicular direction."—In line 6, paragraph 12, from commencement, for "this drawing-board" read "the drawing-board."—Line 4, paragraph 13, for "figures" read "figure."—Lines 4 to 7, paragraph 2, for "and must have the same shape and dimensions in the perspective view that they have in the ground plan and the elevation," read "also lines and surfaces, must have the same shape and dimensions in the perspective view, as given in the ground plan and the elevation."

Our engraver, Mr. W. C. Walker, is in want of a youth, of respectable connexions, as an apprentice to the art of engraving on wood, &c. Mr. Walker's address is 10, Guildford-place, Wilmington-square, Clerkenwell.

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END OF THE TWENTY-FOURTH VOLUME.

INDEX

TO THE TWENTY-FOURTH VOLUME.

A.

Accidents in mines, Report of the House of Commons on, 245. See *Mines*.
——————, Select Committee of the House of Commons on,—Evidence of Mr. J. J. Wilkinson, 264; Mr. N. Wood, 265, 283, 298, 314, 316; Dr. Clanny, 299, 343; Mr. G. Johnson, 315; Mr. G. Stephenson, C.E., 316, 336; Mr. G. Upton, 319, 327; Mr. John Buddle, 329, 505; Mr. Pereira, 336; Mr. Dillon, 344; Mr. Murray, 345; Mr. G. Gurney, 405; Mr. Taylor, 412
Achilles' shield, by Flaxman, 151
Aerial ships, practicability of directing, 55
—— navigation by birds, 57, 200
Aerometer, Hutchison's patent, 417
Air, importance of pure, 64
—-, rate of travelling in mines, 284
—-, forcing through tubes to a distance, 285
Air-pump, Mr. Jordan's, 85
——— for ventilating mines, 284
Airy, appointment of Professor, 255
Alloys, list of, used in the arts, 216
Almanacs for 1836, 237, 253
American steam-navigation, Notes of a Traveller on, 44, 76, 115, 257
Animal matter, preservation of, 496
Arabesque ornaments, 128, 148
Arcade, river, Hungerford and Lambeth, 193
Architecture, modern, 26, 127
————, street, improvement of, 141
Arsenic, prevention of poisoning by, 125
Artists, eminent, connected with British manufactures, 106, 108, 110, 151, 175, 182, 204
———, Norwich Society of, 181
Arts and Manufactures, Select Committee of the House of Commons on—Evidence of Mr. J. J. Smith, 105; Mr. John Martin, 108; J. Morrison, Esq., M. P., 126, 138; Mr. Thomas James, 143; Mr. T. F. Gibson, 144; Mr. R. Harrison, 145; Mr. George Eld, 146; Mr. R. Butt, 147; Mr. C. H. Smith, 150; Mr. George Foggo, 151; Mr. S. Wiley, 154; M. Claude Guillotte, 155; Mr. John Henning, 158, 160; Mr. G. Rennie, 171; Mr. Crabbe, 172; Mr. Skene, 175; Mr. Papworth, 180; Mr. Barnes, 181; Mr. Cockerell, 182; M. Bogaerts, 184; Mr. Toplis, 184, 397; Mr. J. C. Robertson, 185, 201; Mr. Wyon, 203
Arts, Society for the Encouragement of, in Scotland, 175
Athenæum frieze, 94, 158
Atlantic, suggestions on the navigation of, by steam, 258
Atmospheric-engine, new, 408
Austen's steam-engine, performances of, 197, 207
Automaton, speaking, 112
Avery's rotary-engine, 49, 104, 432
Axle-boxes, Hynes's patent, 161
Ayres' safety-lamp, 248, 287

B.

Bacon, Lord, Mr. Martin's Life and Character of, 370
Baddeley, Mr. W., on water as a prime-mover, 25; Merryweather's improved fire-engine, 226; on the use of zinc gutters, 251; report of London fires in 1835, 353
Ballingall, Captain, on the ship-sinking system, 82, 105
Balloon ascent, perilous, 42
——— for releasing whalers from ice, 251
Balloons, caoutchouc, 436
———, on guiding, 55, 200
Bamboo cane, cultivation of, 16
Barlow's, Professor, second report on railways, 366
Barnes's standing-press, 113
Barometer, use of the, to indicate gas in mines, 317
————, new self-registering, 408
Barton's new safety boiler, 224
Beds, new material for stuffing, 324
Beet-root, sugar from, 512
Bell-rock lighthouse, 208
Bells, alloy for, 217
Bergin's patent railway buffing-apparatus, 1
Berlin schools of design, 138
——- iron-works, 148
Billon, alloy for, 216
Birds, aerial navigation by, 57, 200
Birmingham Society of Arts, 203
—————, gun manufacture of, 464
Blasting mines, danger attending, 303, 336
——————, Taylor's improved mode of, 412
Blowers in coal-mines, 302, 315, 316, 329, 336
Boat, fishing, improved, 222
——, Cow's caoutchouc, 442
Bobbin-net lace machinery, Croft's patent improvements in, 348, 377
Bog-roads, on the construction of, 30, 204
Boiler. See *Steam-engine.*
Boiling water, alloy fusible in, 217
Bone-crushing machine, 351
Booth's, Mr. D., safety method of lighting coal mines, 392
Boxes, axle, Hynes's patent, 161
Bramah, Mr. Joseph, memoir of, 254
Brande's, Professor, experiments with caoutchouc, 472
Brass, alloys for, 217
——, solder for, 218
Breakwater, Portland, 112
Bricks, evil effects of duty on, 184
——-, superiority of machine-made, 542
Brick-paving, remarks on, 261
Bridge, Sunderland, 28
——— from Dover to Calais, Smeaton's, 28
———, London, 28

Bridge, Fribourg suspension, 160
——, Hungerford and Lambeth foot-passenger, 193
Bridges, iron, 28
British architects, institute of, 96, 181, 288, 384
British Museum, 107, 109, 112, 138, 148, 158, 169, 174, 277, 431, 452, 507, 525, 535
Bronze manufacture, 147, 151
—— medals, &c., alloys for, 216, 217
Brunel's, Mr., tunnelling labours, 68, 131
Buckingham House, 26
—— ploughing match, 54
Buddle, Mr. John, evidence of, on accidents in mines, 329, 505
Bude light for lighthouses, 406
Buffing apparatus, Bergin's patent, 1

C.

Cab, Hansom's new safety, 444
Calculating machines, 48
—— rule, Henshall's, 468
Calico-printing, Losh's improvements in, 346
Canal and railway combined, 117
Candles, use of, in mines, 265, 269, 286, 303, 317, 329, 335
Cannon, alloy for, 217
Caoutchouc roofs, 89
—— new fabric, 254
——, patent, case of Macintosh *v.* Everington, 416, 460, 469, 489, 508, 529
—— manufacture, historical retrospect of the, 434
Carpets, Scotch imitation of French, 179
Carriage-wheels, Hynes's patent apparatus for locking, 162
Cart, excavating and self-loading, Palmer's patent, 289
Carts, French, 95
Carving, Gothic, &c., 150
Cashmere shawls, 144
Casks, how to purify, 112
Chairs, railway, best form for, 369
——, Scrivener's wrought-iron, 415
Chasing, gold and silver, decline of, 203
Chemical club, 475, 491, 509
Chilled rollers, &c., new mode of casting, 222
Chimneys, smoky, cure for, 121
——, construction of, 199
——, fires in, 355
China-painting, 108, 147
Chinese patterns, 185
Choke-damp. See *Mines.*
Clanny's, Dr., safety-lamp, 248, 265, 287, 298, 343
Clark's patent for dissolving India-rubber, 477
Clock, Dobbs' improved, 86
Clyde Iron-works, use of the hot-blast at the, 211
Coach painting, 108
Coal, examination of the nature of, 265
Coal-mines. See *Mines.*
Coal-oil for dissolving caoutchouc, 461. See *Caoutchouc.*
Coal-tar for preserving stone, 220
Coals, quantity of, used in manufacturing a ton of cast-iron, 214
Coinage, allegorical designs on the, 204
Colour, Professor Bache's experiments on the influence of, on heat, 325
Colours, superior brilliancy of French, 143, 174
Comet, Halley's, 9, 11, 29, 42, 254, 320
——, new, 16
Comets, the nature of, 227
——, number of, 238
Concrete, prize essay on, 96, 384
—— for improving roads, 204
Concussion, extinguishing fires in mines by, 329
——, extraordinary effect of, 400
Cooking stove, improved, 222
Cooper's, Mr. S. T., great achromatic telescope, 209
Copyright of railway plans, 6
——, inefficiency of the present laws to protect, 106, 111, 148, 158, 180, 189
——, American system of, 152
Corn, machine for shelling, 89
Cornwall Polytechnic Society, report of, 84
——, premiums offered by, 196
——, mines of, 304
Cossipore Foundry, iron-trussed roof of, 305, 351
Cotton packing for steam-engines, 118
Cowl, improved chimney, 121, 320
Croft's improvement in bobbin-net lace machinery, 348, 377
Curve of least resistance on railways, 280
Cymbals, &c., alloy for, 217

D.

Danube, navigation of the, 95
David's, St., cathedral, restoration of, 28
Davy, Mr. C., on fire-proof buildings, 22, 74
Davy's, Sir H., safety-lamp, 246, 265, 287, 298, 319, 327, 332, 336, 338, 345, 393, 500
—— analysis of fire-damp, 341
Deakin, Mr. Thomas, on the Thames Tunnel, 131; on the long-work system of mining, 505
Deflectometers, Professor Barlow's, 367
Dickson's self-feeding and smoke-consuming furnace, 215
Dillon's safety-lamp, 248, 344, 346
Dipping-needle, Fox's experiments on the, 86
Distilling, Capt. Embree's method of employing escape-steam for, 456
Diving apparatus, Condert's, 65
—— dresses, caoutchouc, 442
Douglas's safety-lamp, 248
Drawing, necessity of instructing artisans in, 109, 160, 177, 185
Dresden china, French imitation of, 147

E.

Eagles, for the traction of balloons, 200
Electrical theory of the universe, Mackintosh's, 11, 227, 292, 350, 461, 419

Electrical machines, amalgam for cushions of, 218
Electricity and vegetation, Mr. Pine on the probable connexion between, 99, 402, 537
————, ventilation of coal mines by, 393
————, from India-rubber, 475
——————— paper, 525
Elgin marbles, 109, 173, 180, Mr. Henning's casts of the, 169
Embree's, Captain, method of employing escape steam for distilling, 456
Enamel painting, 109
Englishman's Almanac for 1836, 253
Engravings in relief, metallic, 189, 277
—————, wood, 189
—————, multiplication of, 189
—————, copper-plate, 201
Erard's patent for piano-fortes, extension of term of, 239
Excise laws, evil effects of, on British art, 110, 184, 201
Eudio-engine, Brackenbury's, 282
Excavating cart, Palmer's, 290
Eye, power of the, 48

F.

Falcon. rapidity of its flight, 58
Faraday's, Dr., memoir on caoutchouc, 440
Fenders, manufacture of, 107
Filagree-work, silver, 148
Fire-arms, alloy for the mounting of, 217
Fire-damp. See *Mines*.
————, analyses of, 341
Firemen, rewards to, 355
Fire-engine, Merryweather's improved, 225
—————, Nickoll's patent steam, 386
—————, establishment, London, 353, 364, 416
Fire-proof buildings, 22, 74
Fires, London, in 1835, 353
Fish, drowning a, 16
——, fecundity of, 16
——, improved mode of catching, 223
——, new mode of stuffing, 263
Flax, spinning, 112
Flints, soap from, 487
Flooring, double under, Lord Stanhope's method of, 22
Foley family, origin of the, 288
Fossil remains, Mr. Hawkins's, 452, 526
French and English manufactures, 109, 112, 126, 138, 155, 158, 171, 176, 186, 205
Fribourg suspension-bridge, 160
Furnace, self-feeding and smoke-burning, 129, 215
————, calculation of power of, to ventilate mines, 283

G.

Galloway's new patent paddle-wheel, 241, 271, 278, 295, 380
Gas, explosions of, in mines. See *Accidents in Mines*.
——, test of, 288
—— cooking-apparatus, Hicks's, &c., 13, 80, 122
——, *engine, new*, 282
Gas-lighting, invention of, 59
———— projects, Matthews's, 445
————- for shipping, 512
—— valves, water, 73, 137, 311, 408
Gasometer, Hutchison's double-lifting, 321, 380, 413, 443, 455, 495
Gentleman's Diary for 1836, 239
Geology, Mackintosh's electrical theory of the universe confirmed by, 419
George IV., architectural taste of, 27
Ginger, application of, to tanning, 324
Glass, soluble, on the manufacture of, 515
Glass-painting, 110
Globes, caoutchouc, 437
Gloves, caoutchouc, 436
Gold, French manufactures in, 147
—— coins and medals, alloys for, 216
——, solder for, 218
——, amalgams of, 218
——, extensibility of, 416
Gongs, alloy for, 217
Grates, manufacture of, 106
Gray's railway scheme, 134, 159
————— golden rules, 527
Green's, Mr., India-rubber balloons, 529
Grinding-machine, steam, 112
Gun-manufacture of Birmingham, 464
Gunnery, naval, improvement in, 18
Gurney's, Mr. Goldsworthy, safety-method of lighting mines, 405
Guttemburg, the inventor of printing, monument to, 288

H.

Hall's, Mr. S., steam-engine improvements, 464
Halley's Comet. See *Comet*.
Handkerchiefs, India, 143
Hansom's new safety-cab, 444
Hawkins's, Mr., fossil organic remains, 452, 526
Heat, Professor Bache's experiments on the influence of colour and surface on, 325
Henry's, Dr., analysis of fire-damp, 341
Henshall's calculating rule, 468
Herapath, John, Esq., on railways, 20, 51, 64 See also, *Iver M'Iver, Railway-Locomotion*.
Hevea, or caoutchouc tree, account of, 437, 510, 531
Hicks's gas-cooking apparatus, 13, 80, 122
Highgate archway tunnel, 28
Hoare's mode of cultivating the vine, 10, 135
Hosking's portable punching-press, 513
Hot-air blast, Dr. Clarke on the application of, in the manufacture of cast-iron, 211
Hot-water heating system, danger of, 458
Hungerford and Lambeth foot-passenger bridge, 193
Hunter's stone-planing machine, 33, 202, 208
"Huntsman" American steam-vessel, 116, 257
Hutchison's patent portable lever, 273; double-lifting gasometer, 322, 380, 413, 443, 455, 495; patent aerometer, 417

Hutchinson's, Major, iron-trussed roof of the Cossipore Foundry, 306, 307
Hyde Park Corner, 149, 170
Hydraulic-engine, Galt's, 25
——— gas-valves, 73, 137, 311, 408
Hydrostatic engine, Porter's, 240
Hynes's patent wheels, axles, and boxes, 161

I.

Ice, plan for releasing whale-ships from, 251
Images, plaster of Paris, 189, 262
India, resources of, 519
—— handkerchiefs, mark of gentility, 143
India-rubber. See *Caoutchouc.*
Indian-ink, receipt to make, 197
—— corn, sugar from, 224
——— East, tobacco, 520
Induction, Bacon's principle of, 373
Inventors, difficulties in the way of, 60
Iron manufacture, British, 105, 149
———————, French, 147
———————, Berlin, 148
——————— by the hot-blast, 211
—— market, British and American, 243
—— trussed roof of the Cossipore Foundry, 305, 351
—— safes, only safe position for, 457
Ivory, sculpture in, 169
Iver M'Iver's examinations of Mr. Herapath's railway theorems, 15, 43, 123, 195, 219, 250, 275, 323, 394, 433, 500

J.

Jacket, self-inflating, 65
Jacquard looms, introduction of, 155, 188
Jewellery, French, 147
————, gold, alloy for, 216
Johnson's patent for India-rubber fabric, 510, 535
Jones's magic-lantern, 113
Jopling's, Mr. Joseph, slate railway-platforms, 97, 124; on Kirkby slate, 164

K.

Kaleidoscope, invention of the, 190
Kirkby slate, 124, 164
Kneading-trough, mechanical, 416

L.

Ladies' Diary for 1836, 238
Lakes, elevated, 48
Lamps, safety. See *Mines.*
Lantern, magic, Jones's, 113
Lardner's, Dr., evidence on the Great Western Railway Bill, 67
Lead, solder for, 218
—— in the atmosphere in white-lead works, 383
Lead mines, antiquity of, 32
Lectures at the London Mechanics' Institute, inefficiency of, 399
Leman's patent improvements in soap, 347
Levels, improved mode of taking, 541
Lever, portable, Hutchison's patent, 273
Lewis *v.* Marling, patent case of, 533
Life annuity scales, Edmond's, 487
Life-buoy, self-inflating, 40
Lighthouse, bell-rock, 208
———— *light, Bude,* 406
Lighthouses, metallic, 480
Limestone deposits, mode of freeing boilers from, 309
Lloyd's, correspondence between Captain Ballingall and the secretary of, 82, 105, 252,
———, evil effects of system of insurance at, 523
Locking carriage wheels, apparatus for, 162
Locomotion. See *Railways.*
Log, simple mariner's, 30
London-fires in 1835, 354
London Wall, old, 128
Long-work system of mining, 502
Longitude, discovery of the, 512
Losh's patent improvements in calico printing, 346
Louis Quatorze style of decoration, 142, 180, 203
Louvre, study of the arts in the, 185

M.

Maceroni, Colonel, on slate railway-platforms, 166, 220; on coal-tar as a preservative of stone, &c., 220; on the state of the art of design in England—taxidermy and travertino, 252; hints on hardening stone, &c., and on the preservation of panoramas, 309
Macintosh's patent caoutchouc manufacture, 439. See *Caoutchouc.*
Mackintosh's, Mr. T. S., electrical theory of the universe, 11, 227, 292, 350, 416, 419; on English and foreign workmen, 205; on the practicability of guiding air-balloons, 60
Macropona, the, 112
Magic-lantern, Jones's, 113
Magnetic influence, 86
Mails, improvement in, 285
Manufactures. See *Arts and Manufactures.*
——————, Society for the Encouragement of, in Scotland, 175
Marble, preservation of, 94
Marine insurance, evil effects of, 82, 105, 252
Mariner's compass, variation of, 87
Martin's safety-lamp, 248, 401
———— Mr. T., Life, &c. of Lord Bacon, 370
Masts, sheer, 497
Matter, new theory of, 227
Matthews's, Mr. W., gas-lighting projects, 445
Mechanics' Almanac, 253
Mechanics' Institution, Coventry, 146
————————————, London, 397
Mechanics' Institutions, beneficial effects of, 191
Mechanics' Magazine, beneficial effects of, on British art, 185
Medals, circulation of classic, 204
———, caoutchouc, 441
Mercantile navy, British, insecurity of, 84
Mercury, amalgams of, 218
Merryweather's improved fire-engine, 225
Meteoric showers, annual, 454
Mincing meat, machine for, 90

Mines, plan for raising miners out of, 85
——, Report of the House of Commons' Committee on Accidents in, 245; extracts from evidence given before Committee, 264, 283, 298, 314, 327, 505
——, summary of deaths by explosions in, 246
——, ventilation of, plans for, 247, 265, 317, 393, 502
——, maps of, 247
——, on the efficiency of, safety-lamps, in, 247, 264, 287, 308, 317, 327, 393
——, Society for Preventing Accidents in, 264
——, examination of the nature of coals of different, 265
——, carburetted hydrogen gas in, 265, 286, 316, 328, 330, 336, 341
——, carbonic acid gas in, 268, 341
——, sulphuretted hydrogen in, 269, 341
——, furnace for ventilation of, 270, 283
——, rate of travelling of air in, 284
——, air-pump for ventilating, 284
——, danger attending the blasting of, 303, 336
——, Taylor's new mode of blasting, 412
——, pillar-working, 314, 335
——, gas in, through not being worked, 316
——, azotic gas in, 316, 341
——, explosions of, caused by south wind, 318
————————, cannot be caused by lightning, 318, 330
——, cannons to extinguish burning gas in, 329
——, unworkable before, worked by aid of lamp, 335
——, analyses of fire-damps of, 341
——, pure hydrogen in, 342
——, Booth's safety-method of lighting, 392; Gurney's, 405
——, long-work system of working, 502
——, accidents in, at Felling, 264; Tyne Main, 269; Hartley, 269; Killingworth, 303, 316; Wilmington, 315; Bensham seam, 315, 329; Springwell, 328, 332; Wallsend, 328, 329; Lawson, 330
Miners never refuse to work, 268
————, moral improvement of, 315
————, no indisposition in, to use lamps, 335
Mitchell's improvements in smelting, 348
Moon, approximation of, towards the earth, 13, 292
——, inhabited, 240
Moore's Almanac for 1836. 237
Motion, new theory of, 228
Mummies, Egyptian, formation of, 496
Museums, public, national and provincial, 107, 108, 126, 141, 146, 148, 152, 168, 171, 507, 525
Music-stands, improved, 512

N.

Nash, Mr., autobiographical passages in the *life of, 26*
Natural history, prize essays on, 85
National Gallery, 109, 138, 141, 151
National Gallery of practical science, 109
Naval architecture, Ballingall's system of, 82, 105
Needle, useless in iron boats, 48
Neilson's process of manufacturing cast-iron by the hot-blast, 211
Newman's safety-lamp, 248
Nickoll's patent railway condensing locomotive, 385
Northumberland House, decoration of, 182
Nottingham hydraulic gas-valve, 137
Novum Organum, Bacon's, 372
Nutation, theory of, 395
Nye's patent improvements in pumps, &c., 347
Or-molu, French designs in, 147
Oxygen-gas, discovery of, 254

P.

Packing, cotton, 118
Paddle-wheels, most advantageous position for, 116
————————, Galloway's new, 241, 271, 273, 295, 380
————————, improvement in boards of, 453
Palladium, 272
Palm-leaf for stuffing beds, &c., 324
Palmer's patent excavating and self-loading cart, 289
Panoramas, hints on the preservation of, 309
Paper, improved machinery for making, 89
——, evil effects of excise duty on, 202
——, electrical shock from a sheet of, 525
—— hanging, new, 128, 145
————————, French, 142, 172
Parkin's patent railway, 234
Partridge's "Merlinus Liberatus," for 1836, 253
Patent Law Amendment Act, 18, 31, 47, 60, 87, 239, 272, 280, 377, 415, 460, 488
Patents, new, English lists of, 96, 191, 255, 351, 447, 543
——————, Scotch, 192, 272, 352, 447, 544,
——————, American, 88, 222, 323
————, French, 255
————, abstracts of specifications of recent English, 346
Pattern drawing, 106, 144, 145, 177, 181
Patterns, French, 127, 143, 144, 156, 176
————, piracy of, 106, 111, 139, 143, 144, 149, 172, 183
Paving, street, 23, 74, 128, 274
————, wooden, 48
————, brick, 261
Pendulum sights for ships' guns, 17
Pereira, Mr., evidence of, and experiments by, on safety-lamps, 336
Percussion-lock, improved, 90
Perkins's steam boiler, 387, 459
Philipians, materials for a new epistle to the, 312; postscript to, 514
Piano-fortes, Erard's patent for, extension of, 239
Pilchard, natural history of, 85

Pipes, caoutchouc, Barclay and Co.'s, 442
Planetary system, new theory of the, 395
Planets, electrical scheme of the, 292
Platina, extensibility of, 416
Ploughs, improved, 90, 91, 223
———, steam, 224
Ploughing-match, Buckingham, mechanical analysis of, 54
Poisoning, prevention of, 125
Pollock's, Sir F., opinion on the Patent Law Amendment Act, 62
Pompei, designs of, 127
Poor, improvidence of the, 95
Polytechnic Society, Cornwall, Report of, 84
——————, premiums offered by, 196
Portland Breakwater, 112
Press, Barnes's standing, 113
Priestley, Dr., memoir of, 254
Printing-press, Trevillian's improved, 86
Porcelain manufacture, French, 147
Pump, tread, Bachmann's, 323
———, fountain, Shalders', 481
Pumps, working ships', 159, 260
———, Nye's patent improvement in, 347
Punching-press, portable, 86, 513

R.

Railway, Bath and Basing, 453
———, Bath and Weymouth, 160
———, Birmingham, 124, 366
———, Brighton (Cundy's), 7, 166
———, Brighton (Sir John Rennie's), 166
———, Brussels, 48
———, Dublin and Kingstown, 2, 160
———, Eastern Counties, 52, 64
———, German, first opening of, 255
———, Great Western, 67, 453
———, Greenwich, 6, 20, 47, 48, 133, 166, 206, 221, 512, 542
———, Leeds and Selby, 542
———, Liverpool and Manchester, 2, 21, 366, 400, 496
———, London and Portsmouth, 159
——— bars, experiments on the strength of, 366
——— blocks, most advantageous position for, 368
——————, Parkin's patent, 235
——— buffing-apparatus, Bergin's, 1
——— and canal, combination of, 117
——— carriage, Nicholl's patent condensing, 385
——— carriages, concussions of, 2
——————, improved wheels and boilers for, Baldwin's, 325
——————, new, 512
——— chairs, best form for, 369
——————, Scrivener's wrought-iron, 415
———, continuous stone, 411
——— locomotion, principles of, 15, 21,, 43, 67, 123, 134, 194, 195, 219, 220, 250 272, 275, 280, 297, 319, 323, 349, 381, 382, 394, 433, 453, 500
Railway plans, copyright of, 6
——— platform, Jopling's improved slate, 97, 124, 166, 220
——— table-cloth, 286
——— tunnels, ventilation of, 296, 416
——————, Mr. Gibbs' remarks on, 382
———, wheelbarrow with its own, 447
——— speed, extraordinary, 224
——— system, the, effects of, 96, 447
——————, Gray's, 134, 159, 527
——————, March's, 304
Railways, Professor Barlow's second Report on, 366
———, adhesion on, 496
———, foreign, 447
Rapson's patent steering-apparatus, 449
Razor-sharpener, Dr. Pring's, 8
Reading-room of British Museum, inconvenience of, 431, 535
Read's patent water-engine, 240
Register, steam-engine, 85
Rider's Almanac for 1836, 253
Roads, bog, on the making of, 30, 204
Robertson, Mr. J. C., evidence of, on British arts and manufactures, 185, 201
Rocks, Taylor's new mode of blasting, 412
———, stratified, inclination of, 429
———, derivation of the secondary and tertiary, 429
Roget's, Dr., sliding-rule, 501
Roof, iron-trussed, of the Cossipore Foundry, 306, 351
Roofs, water-proof, 89
Rotary-engine, Avery's, 49, 104, 432
Royal Academy, 127, 148, 152, 171, 176
Royle, Mr. J. F., on the cultivation of tobacco in India, 519
Rudder, Rapson's patent, 449

S.

Safes, iron, only safe position for, 457
Safety-cab, Hansom's patent, 444
Safety-lamp, Sir H. Davy's, 246, 265, 287, 298, 319, 327, 332, 336, 338, 345, 393; Dr. Clanny's, 247, 265, 287, 298, 343; Mr. Stevenson's, 247, 265, 317, 336, 342; Messrs. Upton and Roberts's, 247, 319, 327, 334, 337, 344; Mr. Newman's, 248; Mr. Martin's, 247, 401; Mr. Douglas's, 267; Mr. Wood's, 247, 343; Mr. Dillon's, 247, 342, 344, 346; Mr. Ayres', 248, 287; Mr. Robson's, 343.
———, mode of cleaning, 289, 391
—————— testing, 331
———, general use of, in collieries, 331, 334
———, no disinclination in miners to use, 334
———, collieries worked by aid of, unworkable before, 335
——— may be exploded in blasting coal, 336
Salt, manufacture of, 112
Sap of plants, powerful electric conductor, 537

Saw, improvement in the use of the, 223
Sawing, extraordinary performance, 447
Scavenger, mechanical, 416
Schools of design, 138, 142, 144, 146, 148, 151, 152, 168, 173, 176, 205
Science, definition of the term, 9
Scotland, Societies for the Encouragement of Arts and Manufactures of, 175
Scrivener's wrought-iron railway chairs, 415
Sea-water purifying-apparatus, Wells's patent, 488
Seals, amalgam for taking impressions of, 218
Seeds, machine for cleansing, 91
Secret processes, difficulty of protecting, 190
Shalders' fountain-pump, 481
Shawls, Cachemere, 144, 145
——, French, India patterns, 176
——, Scotch, 179
Sheer-masts for large ships, 497
Ship-sinking system, 82, 105, 252, 523
Ships' pumps, modes of working, 159, 260
Sights for ships' guns, pendulum, 17
Silk trade, patterns in, 127, 143, 180
—— manufacture, English and French, 143, 144, 145, 155, 187
Silver filagree-work, 148
—— chasing and designing, 151
—— coins, &c., alloys for, 216
——, amalgams of, 218
——, extensibility of, 416
Slate railway-platform, Jopling's, 97, 124, 166, 220
——, Kirkby, 124, 164
Sliding-rule, Henshall's, 468
——, Dr. Roget's, 501
Smelting ores, Mitchell's improvements in, 348
Smoke-consuming furnace, 129, 215
Smoky chimneys, cure for, 121
Soap, Leman's patent, 347
——, Sheridan's patent, 487
Soda, sulphate of, Phillip's improvements in the manufacture of, 347
Solders used in the arts, list of, 218
South Sea Islands, traces of ancient civilisation of, 95
South wind, mine explosions caused by, 318
Sowerby's patent ship's windlass, 41
Specification, first amendment of, under the late Patent Law Act, 272, 280
——, "monster," 348, 377
Specifications, abstracts of, of recent patents, 346
——, Attorney-General's remarks on drawing, 352
Springs, caoutchouc, 437
Standing-press, Barnes's, 113
Stanhope's, Lord, experiments on making buildings fire-proof, 22, 74
Statues, alloy for bronze, 217
Steam-boilers, explosions of, 44, 308, 388
——, plan for measuring the supply to, 86
Steam-boilers, American marine, 119
——, Barton's new safety, 224
——, Capt. Embree's mode of freeing, from deposits, 309
——, Fox's apparatus for regulating supply of water to, 323
——, Baldwin's improved, for locomotives, 325
——, Perkins's circulating, 387, 459
—— cock, two-way, to answer purposes of four-way, 24
—— engine, Austen's, performances of, 197, 207
——, Capt. Embree's mode of employing escape-steam from, for distilling, 486
——, Hall's patent, 464
——, rotary, Avery's, 49, 104, 432
——, Hero's, 104
——, Giovanni Brana's, 104
——, Saddler's, 104
——, Mackintosh's, 206
—— register, 85
—— work, 160
—— fire-engine, Nicholls's patent, 386
—— navigation, American, notes of a traveller on, 44, 76, 115
——, early days of, 59
—— between England and America, 95
—— plough, 224
—— vessel, American, economy of, 45, 75
——, description of, 115
——, "Huntsman," 116, 257
——, De Witt Clinton, 432
Steel-pen holders, whalebone, 292
Steel's self-feeding and smoke-burning furnace, 129
Steer, Mr. John, opinion on the Patent Law Amendment Act, 63
Steering-apparatus, Rapson's, 449
Stevenson's, Mr., safety-lamp, 248, 265, 336, 317, 342
Stone-planing machine, Hunter's, 33, 202, 208
——, preservatives of, 220, 263, 309
—— railway, continuous, 411
Street, new, 64
Sugar from Indian corn, 224
—— beet-root, 512
—— pan, Dr. Ure's patent corrugated, 465
Sulphur, a preservative of stone, &c., 263, 309
Sunderland Bridge, 28
Surface-printing machine, Losh's patent improvements in, 346
Surfaces, rough and smooth, influence of, on heat, 325
Suspension-bridge, Fribourg, 160
Symington's paddle-wheel, 380
Syphon, easy method of filling a long, 384

T.

Tailors' shears, improved, 223
Talebois, Capt., on American steam-navigation, 47, 76, 115, 258
Tanning, American improvement in, 324
Taxidermy, hints on, 263
Teeth, alloys for plugging, 217, 218
Telegraph between London and Paris, 95
Telescope, Mr. Cooper's great achromatic, 209
——— reflectors, alloy for, 217
Temperance Societies in America, 16
Temperature of Europe, change of, 429
Tents, caoutchouc, 436
Thames Tunnel, memoir on the, 68, 131
Theodolite, improved, 88
Thermometrical scale, new, 400
Thomson's, Dr., analysis of fire-damp, 341
Thrashing-machine, improved, 90
Throstle-frame spindle, Whitelaw's improved, 536
Tides, new theory of the, 12
Tinning iron, alloy for, 217
Tobacco, new mode of preparing, 224
———, Irish and Virginia, 240
———, East Indian, 519
Toplis, Mr., evidence of, on arts and manufactures, 184, 397
Torches, caoutchouc, 437
Transit, railway, 447
Travertino of St. Peter's at Rome, 263
Tree, fossil, 240
Trees, Sir Henry Smart's method of transplanting full-grown, 253
Trevethick's, Mr., tunnel under the Thames, 69
Tuning, defects in present system of, 541
Tunnel, Highgate Archway, 28
———, Thames, 68, 131
Tunnels, railway, 296, 382, 416
Turning stone vases, 33
Turpentine, spirit of, for dissolving India-rubber, 474, 477, 535
Tyne, navigation of the, 220
Types, alloy fer, 217

U.

Umbrellas, caoutchouc, 437
Universe, Mackintosh's electrical theory of the, 11, 227, 282, 350, 416, 419
———, system of the, 64
———————, Sir Richard Phillips, 312, 514
Upton and Roberts's safety-lamp, 248, 319, 327, 334, 344
Ure's, Dr., corrugated sugar-pan or teache, 465
Utting, Mr. J., remarks on Sir R. Phillip's system of the universe, 312, 514; improved mode of taking levels, 541

V.

Valve, water gas, 73, 157, 311, 408
Vegetation and electricity, Mr. Pine on the connexion between, 99, 402, 537
Ventilation of mines. See *Mines*.
Vessel, mode of freeing a, of water by her heeling, 72
Vine, Hoare's method of training the, 10,135
Violin, air, 224
Voice, artificial, 112
———, mechanism of the, 496

W.

Wall, extraordinary fall of a, 400
Wall's, Lieut., pendulum sights for ships' guns, 17
Water as a prime mover, 25
———, mode of freeing a vessel of, by her heeling, 72, 159, 215, 260
———, mode of raising, by syphon, 384
——— closet, Stone's improved, 223
——— engine, band, 240
Waves, height of, 160
Waxing marble for its preservation, 94, 170
Wedgwood ware, 109, 188
Weights and measures, Act for the Regulation of, 95
Wells's patent sea-water purifying-apparatus, 488
Wheels, Hynes's patent, 161
———, improved railway-carriage, 325
Wheel-wrench, new, 86
Wheelbarrow with its own railway, 447
White's Ephemeris for 1836, 238
Whitelaw's throstle-frame-spindle, 536
Wind, force of, at different velocities, 56
Windlass, Sowerby's patent, 41
———, Young's patent increased purchase, 92
Windmill, fall of a, 464
——— ship, 48
Wood's safety-lamp, 248, 313
Wood, soluble glass for preserving, 518
Woollgar, Mr. J. W., on Halley's comet, 9, 29, 42; on Henshall's calculating-rule, 468; on Edmonds's Life Annuity Scales, 487; epitome of the problems of Dr. Roget's sliding-rule of involution, 501
Workmen, British and foreign, 205, 239. See *Arts and Manufactures*.
World, probable age of the, 428
Wrench, new wheel, 86
Wyon, Mr., evidence of, on arts and manufactures, 203

Y.

Year, variation in the length of the, 293

Z.

Zinc gutters, 224, 251

9

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